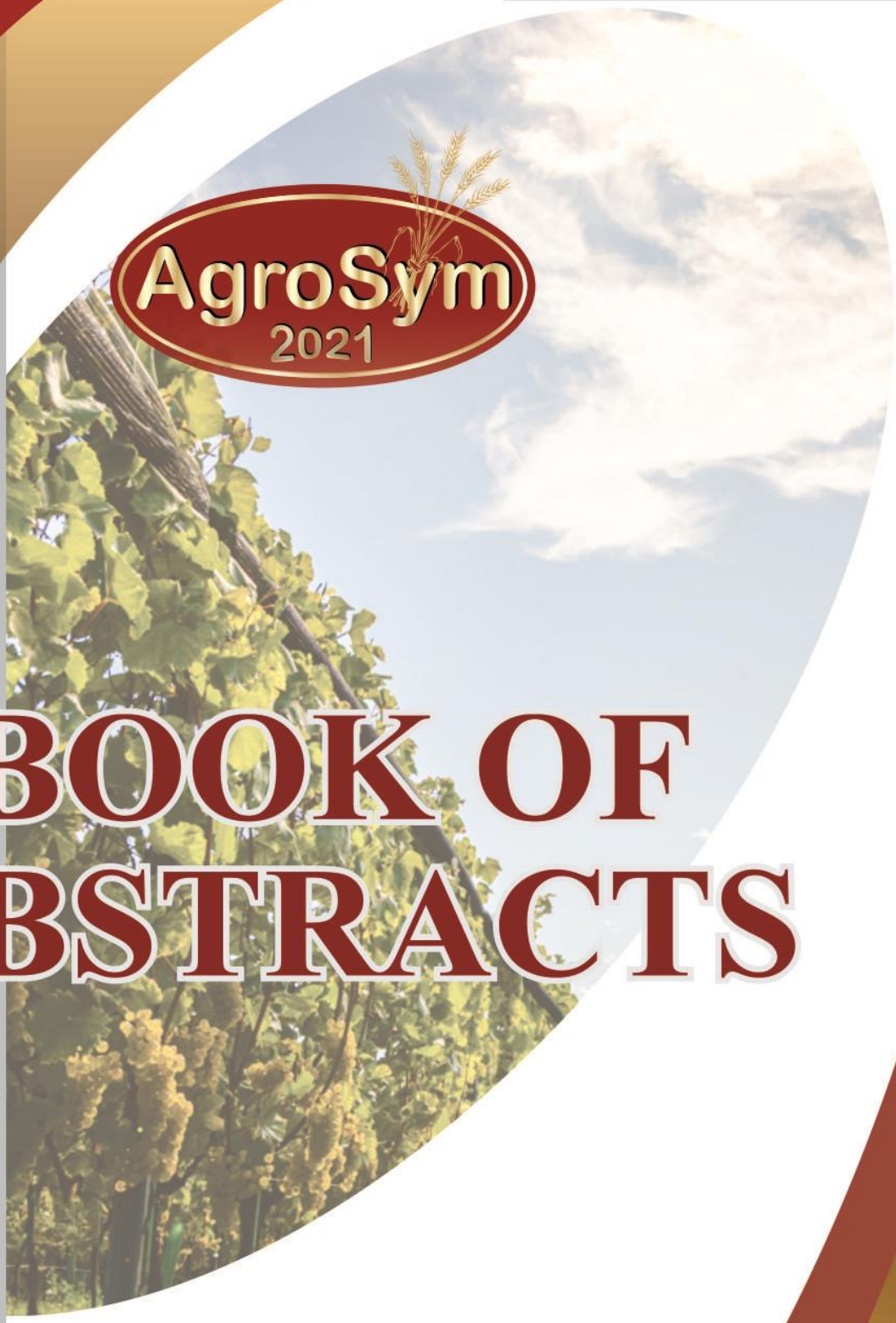

AgroSym 2021

BOOK OF ABSTRACTS

XII International Scientific Agriculture Symposium "AGROSYM 2021" October 7-10, 2021

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PREFACE

Dear colleagues,

In your hands is the Book of Abstracts of the 12th International Scientific Agricultural Symposium "AGROSYM 2021", which I hope you will find useful in your work. As many as 700 contributions have been accepted for the Book of Abstracts. The themes of AGROSYM 2021 cover all branches of agriculture and are divided into seven sessions: 1) Plant production, 2) Plant protection and food safety, 3) Organic agriculture, 4) Environmental protection and natural resources management, 5) Animal husbandry, 6) Rural development and agro-economy, and 7) Forestry and agroforestry.

The multi-functionality of agriculture (viz. crop production, animal production and fisheries) and the central role it plays in food production, food security, rural development, bio-economy (e.g. production of fibres and raw materials for industries) and green economy (e.g. production of biofuels) determine its importance in all countries; especially nowadays, with the second year of the COVID-19 pandemic.

Many scholars and practitioners argue that technology will increase production and feed more people while reducing the variability as well as the environmental impacts of agricultural production. Technology has been particularly important for improving production in non-tree crops such as maize, rice, soybean, wheat and cotton. Because trees have longer cycles, they take longer to improve through traditional breeding programs. New techniques of plant breeding can improve productivity further, but there is a lively academic debate about their pros and cons.

While the focus has been in the past on the production side (cf. productivity, efficiency), more and more attention is nowadays paid to the consumption side as well as the intermediate stages (e.g. processing, distribution) of the food chain thus moving towards a 'farm to fork' approach. Globally, consumers are sending clearer signals than ever before about what they want on their tables i.e. higher quality as well as healthier, safer, and tastier products. Therefore, most companies in the food industry are currently exploring different ways to ensure that they have more control over the production processes for agricultural commodities as well as final products quality. Changes in investment strategy also have the potential to reduce the environmental and social costs of agriculture. It is now apparent to most investors that companies that pay more attention to sustainability and social responsibility, even with the same financial rating, will have better returns both in the short term and over time.

Agri-food systems have been central in the global debate on sustainable development and the achievement of the Sustainable Development Goals (SDGs) as shown by the recent United Nations' Food Systems Summit held in September 2021 in New York. Indeed, agri-food systems are at the center of various global challenges such as climate change, poverty, vulnerability, food insecurity, biodiversity loss, resource scarcity and ecosystem degradation. In this context, one of the goals of the sustainable agriculture movement is to create farming systems that mitigate or eliminate environmental harms associated with industrial agriculture.

Many thanks to all the authors, reviewers and colleagues for their help in editing the Book of Abstracts. Special thanks go to all co-organizers and partners for their unselfish collaboration and comprehensive support.

East Sarajevo, 07 October 2021

Prof. Dušan Kovačević, PhD

Editor in Chief, President of the Scientific Committee of AGROSYM 2021

CONTENT

KEYNOTE PAPERS

REDEFINING THE COMPETITIVE IDEOTYPE OF A MODERN CROP VARIETY: AGRONOMY AND BREEDING PERSPECTIVES

Ioannis TOKATLIDIS

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Abstract

The presentation is mainly based on maize and wheat, because data allowing a deep consideration of the issue are available in these species, however, very likely it concerns most of the grain producing crops. Due to climate change, crop adaptation to environmental uncertainty constitutes a hot research challenge in view of food security in the near future. It is pointed out that modern varieties must consist of the 'weak competitor of high plant yield efficiency' (PYE) ideotype, i.e, individuals able to highly respond to additional inputs (soil water and nutrients; atmospheric air, light, and CO_2). From the agronomy perspective, major reasons to seek the PYE ideotype are the necessity to cope with intra-genotypic variation (plant-to-plant variability), yield loss due to missing plants, unpredictable stresses, and crop dependence on high population densities, as well as to expand the adoption of the low-input agriculture so as to conserve natural resources and prevent soil degradation. From the breeding perspective, it is pinpointed that the PYE ideotype is selectable only at the *nil*-competition regime, i.e., an ultra-low density that precludes plant-to-plant interference for any input. The *nil*-competition regime is an inviolable rule to satisfy the three prerequisites of the breeder's equation, i.e., enhanced phenotypic expression and differentiation, optimal heritability, and high selection pressure. The development of varieties comprising genotypes of high PYE is a viable option to reach crops resilient serving sustainability to fluctuating agroecosystems.

Keywords: *competition, climate change, crop resilience, resource use efficiency*

Acknowledgment: This research has been co- financed by the European Union and Greek national funds through the Operational Program Competitiveness, Entrepreneurship and Innovation, under the call RESEARCH – CREATE – INNOVATE (project code:T1EDK-00739)

FACTORS DRIVING RECENT AND PROJECTED DEVELOPMENTS IN WORLD AGRICULTURAL MARKETS

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Abstract

The pandemic caused a severe recession and disrupted supply chains, putting downward pressure on prices for many agricultural products in the early months of 2020. Over the last twelve months, however, prices of grains, oilseeds, pork, and a number of other commodities have increased sharply. The presentation will discuss some of the factors that drove these recent developments, including a recovery in the global economy, weather conditions that limited grain exports by Brazil, a change in China's grain import behavior, African swine fever's impact on pork production and trade, and the expansion of the renewable diesel fuel industry in the United States. The Food and Agricultural Policy Research Institute (FAPRI) has recently completed an update of its projections for world agricultural markets. Under a plausible set of assumptions, world indicator prices for many agricultural products peak in the current marketing year but then subside. Changes in several key drivers could alter these baseline projections. In any given year, weather conditions in important producing countries will cause volatility in production and prices. The pandemic remains an important source of uncertainty, and future animal diseases could also impact markets. China could further expand its grain and oilseed imports or again decide to prioritize the minimization of grain imports. Exporters in South America and the Black Sea region could expand production more or less rapidly. Climate change could affect patterns of global production, especially in the longer run, and climate change policies may have important impacts even in the near term. The presentation will discuss the implications of these recent and potential developments for farmers, agribusinesses, taxpayers and food consumers.

Keywords: *agricultural market, indicators, pandemic.*

CUTTING-EDGE CROP BREEDING WITH CRISPR-CAS GENOME EDITING TECHNOLOGIES

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Abstract

Genome editing technologies based on CRISPR-Cas systems are revolutionizing plant research and agriculture. This talk will first provide a general overview of the landscape of the cutting-edge CRISPR genome editing tools, including CRISPR-Cas9, CRISPR-Cas12a, CRISPR-Cas12b, C-to-T base editors, A-to-G base editors, and prime editors. Then, I will present a few case studies for the application of these tools different plant species, including rice, maize, wheat, carrot, tomato, and poplar. Next, I will introduce highly efficient multiplexed genome editing systems based on CRISPR-Cas9 and Cas12a. Their powerful applications will be showcased in rice, such as simultaneous editing of multiple crop traits, targeted protein evolution for herbicide resistance, and creation of quantitative traits by editing cis-regulatory elements. Finally, I will talk about an exciting gene activation technology, CRISPR-Act3.0, and its use for accelerating crop breeding and metabolic engineering. Collectively, these CRISPR technologies will greatly aid the development of high-yield, nutritious and resilient crops to feed the growing population worldwide.

Keywords: *genome editing technologies, agriculture*

1.PLANT PRODUCTION

EFFECT OF WATER STRESS ON THE BEHAVIOR OF SIX DURUM WHEAT GENOTYPES IN A SEMI-ARID REGION OF WESTERN ALGERIA

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Abstract

Six genotypes of durum wheat (*Triticum turgidum* L. subsp. *durum* (Desf.) Husn.) were investigated under different watering regimes. Phenological and morphological parameters as well as some yield components were monitored. The results show that: (1) the water deficit significantly affects the height of the plants, the length and the weight of the spikes. (2) Irrigation has a significant effect on all of the yield components. Doses of 39 mm at tillering, 60 mm at stem elongation and 30 mm at heading stage achieved the best yields. (3) Earliness at heading and at maturity is an important factor in determining the adaptation to water stress and in obtaining a good yield. (4) Under favorable irrigation conditions precocious and semi-precocious selected varieties have been shown to be more productive and even adapted to the water stress of the region. (5) The productivity of the durum wheat crop is imperatively based on the choice of a tolerant genotype to the conditions of the region on one hand and on the use of supplementary irrigation on the other hand, especially at the vegetative stage where the yield component is the most determining. In our case it seems to be the populating spike carried out at the booting stage.

Keywords: *Durum wheat, genotypes, precocity, water deficit, semi-arid region.*

PHYSICO-CHEMICALSTUDY AND ANTIOXIDANTACTIVITY OF FIVE ALGERIAN HONEYSAMPLES

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Abstract

Honey is a naturally sweet natural substance produced by a bee of the genus called ApisMillefera. The objective of our work is to make a physicochemical and photochemical study of some types of honey harvested in different regions of Bejaia such as (Toudja, Fenaia, Amtik, Boukhlifa) including one from Germany. Physicochemical results have shown that there are differences from one sample of honey to another and they meet international standards. The determination of sugars revealed that some samples (E1, E3 and E5) slightly exceeded the standard recommended by the food codex. A very highly significant positive correlation was recorded between electrical conductivity and ash content (r = 0.94). Quantitative analysis of total polyphenols using the FolinCiocalteu reagent as a method of determination showed a difference in the total phenolic composition of honeys studied. The antioxidant activity of the different samples was evaluated by different methods: free radical scavenging DPPH and reduction of ferric chloride for reducing power.

Key words: *honey, physical and chemical, phytochemical, food Codex, Correlation and antioxidant activity.*

GENETIC STRUCTURE OF BARLEY (HORDUM VULGARE L.): ACCESSION COLLECTIONS FROM ALGERIA

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Abstract

Little is known about the diversity of barley in Algeria. An inventory has been conducted in western of Algeria to collect local accessions of barley (*Hordeum vulgare* L.) for their morphological characterization. In this context, a collection of 34 traditional and new accessions of barley was investigated using 12 quantitative and 18 qualitative agro-morphological traits. The phenotypic diversity was determined by the Shannon-Weaver diversity index (H') at different levels (sample Totality, by type of barley and varietal name). The H' estimates showed a wide phenotypic variability for different traits with H' averaging 0,74 and 0.53 from quantitative and qualitative characters, respectively. The results of the multiple correspondence analysis and hierarchical clustering showed a clear distinction between the different accessions. These results indicate that the selected samples were sufficiently effective in detecting the diversity of the Algerian accessions studied. This study gives us a real genetic potential on barley in Algeria.,This result can be very useful in biodiversity management and genetic improvement.

Keywords: *barley, accessions, morphological diversity, microsatellite markers (SSR), Algeria.*

COMPARATIVE STUDY OF KERNEL TRAITS AMONG THE DIFFERENT WHEAT-ALIEN AMPHIPLOIDS IN CONDITIONS OF ABSHERON PENINSULA

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Abstract

Kernel morphological traits significantly correlate with grain weight and have direct impacts on wheat yield and quality. With using of numerous wild-growing species of the tribe *Triticeae* related to common wheat, a large number of "bridges" - synthetic forms or artificial amphiploids have been developed by researchers for the genetic studies and exploitation in traditional breeding. The aim of our study was the comparative study of some kernel morphological traits among different wheat-alien amphiploids obtained from the gene bank of WGGRC (USA) and grown for several years in the local open field conditions of Absheron Peninsula (Azerbaijan). Data collected from this study will contribute the correct combination and use of these amphiploids as initial parental forms in expected hybridization procedures. A complete set of 5 wheat-alien amphiploids used in our study were: *Triticum turgidum / Dasypirum villosum*, *Triticum* sp. / *Elymus arenarius*, *Elymus ciliaris / Triticum aestivum* cv. Inayama Komugi, *Triticum aestivum / Agropyron distichum*, *Triticum aestivum / Thinopyrum intermedium*. The local soft (*T. aestivum* cv. Abşeron) and hard wheat (*T. durum* cv. Saray) cultivars were used as the controls. The randomly selected and fully filled 30 seeds collected from each mature plant of studied samples were measured in millimeters using a ruler and estimated by the average of three measurements of the last three years. The largest kernel length was recorded for *Triticum turgidum / Dasypirum villosum*, while the other traits (kernel width and thickness) in the all studied amphiploids were inferior to the both control wheat cultivars.

Keywords: *Kernel morphology, Wheat-alien amphiploids, Absheron Peninsula.*

BIOSTIMULANTS FOR ENHANCING PLANT ABIOTIC STRESS TOLERANCE

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Abstract

In a modern world deprived and driven by technology, learning to 'do smarter and not harder' is the first step towards sustainability. With the introduction of sustainable agriculture, bio-stimulants came into play as a bridge, when applied to crops or seeds, bringing about changes in physiological and structural processes to influence plant growth via reduced use of synthetic chemicals and fertilizers, improved tolerance to various stresses, efficacy in nutrient uptake and use, and improved, good quality yield. Biostimulants are a group of substances or microorganisms, with a positive impact to enhance plant growth, availability of nutrient, and improvement of stress tolerance in crop plants. Biostimulants are mostly exogenous compound(s) or microorganisms, applied in plant or root zone (rhizosphere) to improve nutrient uptake, plant growth, crop quality and abiotic stress tolerance. In the recent years several biostimulants have been used for crop production including humic and fulvic acids, seaweed extracts, protein hydrolysates; mixture of oligopeetides, polypeptides and amino acids, N-containing compounds; glycine betaines, polyamines, and non-protein amino acids, chitosan, inorganic compounds; trace elements (selenium, Se; and silicon, Si), beneficial fungi; mycorrhizal fungi and *Trichoderma*, and beneficial bacteria; plant growth-promoting rhizobacteria (PGPR). These biostimulants not only resulted in better plant growth and development, but also provided better tolerance to various stresses. Moreover, modern agriculture is shifting toward organic environment amicable and everlasting systems to improve yield as well as crop quality without increasing the inputs. To achieve sustainability, species-specific breeding programis going on, which is time-consuming. Contrary, an improved cultivar from breeding program may not be tolerant of the abiotic stresses, ieit may tolerate one or two specific abiotic stress conditions. Therefore, biostimulants could be an excellent and viable alternative in this condition, because they are capable to enhance the growth of plants, improve the nutrient uptake, increase tolerance to biotic and abiotic stresses, and expand crop quality traits along with a good yield.

Key words: *biostimulants, plant, abiotic stress.*

ENHANCEMENT OF THE CUCUMBER SEEDLING QUALITY THROUGH PRIMING WITH NaCl

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Abstract

An experiment was carried out at the research field of the Department of Horticulture, Hajee Mohammad Danesh Science and Technology University (HSTU), Dinajpur, Bangladesh to evaluate the growth and development of cucumber seedlings as affected by priming with NaCl. Experimental treatments consisted of priming with control (without priming), hydroprimimg (with water) and 7 levels of NaCl (0.5%, 1.0%, 1.5%, 2.0%, 2.5%, 3.0% and 4%). The single factor experiment was conducted in the Randomized Complete Block Design with three replications. Seeds of cucumber *cv*. Ufshi were collected from the Nilsagor Seeds and Tissue Culture Limited, Bangladesh and seeds were soaked in the desired solutions for eight hours. Twelve growth and development attributes were compared most of which differed significantly ($p \leq 0.05$) among the treatments. Regarding the germination, the highest percent (97.14%) was obtained in seeds priming with 0.5% NaCl solution. The highest shoot length (19.00 cm), shoot diameter (3.81 mm), root length (14.33 cm), root diameter (0.13 cm), number of leaves (4.16), longest root length (10.58 cm), percent of root dry weight (0.29%), percent of shoot dry weight (2.10%), chlorophyll-a content (3.18 mg/100 ml) and leaf area (931.3 mm^2) were recorded in seeds priming with 0.5% NaCl solution at 30 days after dibblings. The percent of abnormal seedling was higher (8.57%) in 4% NaCl, while the least (2.85%) was in 0.5% NaCl solution. The highest number of functional roots (22.33) was in hydropriming, and highest content of chlorophyll-b was in 2.0% NaCl solution. The results suggested that among the different treatments, the seedlings grown in priming with 0.5% NaCl solution resulted in the overall good seedlings growth of cucumber.

Keywords: *Seedling, Quality, Priming, NaCl, Cucumber.*

THE INFLUENCE OF FERTILIZATION WITH PYROPHYLLITE ON VEGETATIVE GROWTH OF WHITE HEAD CABBAGE

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Abstract

In this study, research is focused on the application of pyrophyllite fertilization in combination with mineral fertilizer NPK (15:15:15) on the vegetative growth of cabbage hybrids Bravo F_1. Research was conducted during 2018. year and 2019. year at the Institute of Agriculture of FBiH. The aim of the study was to determine the extent to which the vegetative growth of cabbage depends on different doses of pyrophyllite combined with a standard amount of NPK mineral fertilizer. The influence of the following fertilization variants was investigated: var. 1 (control) - 800 kg/ha NPK 15:15:15, var.2 – 800 kg/ha NPK 15:15:15 + pyrophyllite 2.200 kg/ha, var.3 - 800 kg/ha NPK 15:15:15 + pyrophyllite 700 kg/ha, var.4 -800 kg/ha NPK 15:15:15 + pyrophyllite 1.200 kg/ha, var.5. 800 kg/ha NPK 15:15:15 + pyrophyllite 700 kg/ha. The highest dose of applied pyrophyllite per unit area (2.200 kg/ha) had the greatest impact on the vegetative growth of cabbage.The results of the study indicate that the application of pyrophyllite can reduce the use of mineral fertilizer in the production of cabbage without adverse effects on the parameters of its vegetative growth.

Keywords: *fertilization, pyrophyllite, cabbage, vegetative growth.*

FUNCTIONAL FOOD - PRODUCTS FROM TOMATO WITH LYCOPENE IN PREVENTION OF CARDIOVASCULAR DISEASES

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Abstract

Tomato, as a functional food product, includes a source of lycopene that serves to prevent cardiovascular disease. The aim of this study is to perform a comparative analysis of the microbiological and chemical characteristics of different tomato products available to buy at the area of Mostar, Bosnia and Herzegovina. Tomato products for analysis were randomly sampled and bought from shopping centers in Mostar area from three different producers: Sample no. 1: "Passata" - sterilized tomato paste, producer "Podravka d.d." Country of origin: Croatia, Sample no. 2: "Russo" - tomato paste, producer "AR Industire Alimentari S.p.A", country of origin: Italy and Sample no. 3: "Sava Semberija" - tomato juice producer "Sava Bijeljina" country of origin: Bosnia and Herzegovina. Following parameters were included in the microbiological analysis: *Salmonella, Koagul. poz. staphilococae, Sulph. red. clostridiae, Proteus species, Escherichia coli* and total bacterial count. Chemical analyses were based on determination of lycopene content and artificial colors. The results were compared with the provisions of the Rulebook on the conditions regarding chemical and microbiological safety, which must be met by food products in transport, Official Gazette of the Republic of BiH 2/92, Rulebook on microbiological criteria for food (Official Gazette of BiH No. 11/13), as well as with literature sources. The obtained results indicate significant nutritional value of the samples in our diet, especially from the aspect of human health and prevention of cardiovascular diseases. For instance, lycopene is an antioxidant that cannot be created naturally by the human body, as it is exclusively of plant origin.

Key words: *tomato, lycopene, cardiovascular disease, prevention.*

INFLUENCE OF DIFFERENT FERTILIZATION MODELS ON THE MORPHOLOGY OF GALA SHNIGA APPLE LEAF (Malus domestica L.)

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Abstract

In this research, the influence of different fertilization methods on the morphological characteristics of Gala Shniga leaf leaves in the agroecological conditions of Sarajevo during 2019 and 2020 was studied. The studies included dietary treatments: control variant (standard fertilization NPK 15-15-15); variant A foliar feeding (Yara Vita Universal Bio); variant B (KAN + NPK). The Gala Shing apple (Malus Domestica L.) originates from New Zealand and was obtained by crossing Golden Delicious and Kidd's Orange Red varieties. Generally speaking, the results showed that the new generation of fertilizers, as well as the method of fertilization through lists show the best results of morphological characteristics of leaf cultivars of apples. The results of the study showed that proper plant nutrition is one of the measures by which it is possible to achieve high yields and good quality of agricultural products. The leaf is the basic part of the plant that performs three very important functions: photosynthesis, transpiration and gas exchange. It also plays a big role in the nutrition of apple fruits. Of the necessary elements, the quality of apple fruits is most affected by: nitrogen, potassium, phosphorus, calcium, magnesium and boron. Their lack or excess can have a very negative effect on fruit quality.

Key words: *Apple variety, Gala Shniga, fertilization, leaf, morphological characteristics.*

THE EFFECTS OF MINERAL FEEDING AND LOCATION ON SEED QALITY OF SEVERAL SORTS OF FORAGE

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Abstract

In a biannual period (years 2016. and 2017.) seed samples from five sorts of forage peas intended for grain production were taken (NS Javor, Baccara и NS Dukat), and combined method of exploatation (NS Junior i Saša), from two locations, East Sarajevo and Banja Luka, so that the effects of the sort, mineral feeding and location (germination energy%, germination% and 1 000 seeds mass), could be tested in the Laboratory of Faculty of Agriculture East Sarajevo. Seed quality was tested by applying standard methods prescribed by Rulebook of agriculture plants seed quality ("The Republika Srpska Official Gazzete, no. 30/98") and ISTA Rules (2007). In 2016. the Baccara sort had the largest percent of germination and germination energy, and in 2017. the largest percent of germination energy had the NS Javor, while the sort Baccara had the largest germination percent. The largest 1 000 seed mass in the testing years had the NS Javor sort: The smallest germnination energy and germination had the NS Dukat sort, and the smallest 1 000 seed mass had the NS Junior sort. Small differences in germination energy and seed germination was detected between seeds in the control variety and the variety where mineral fertilizers were used. Seeds gotten in the variety where supplementation was used next to the mineral fertilization, there was the smallest germination energy and germination, but the largest mass of a thousand seeds. Seeds produced on location in East Sarajevo, had the bigger germination energy and germination, while the location had no effect on The mass of a thousand seeds.

Keywords: *peas, seed, germination energy, germination, the mass of a thousand seeds.*

THE EFFECT OF POLYMER AND LOCATION ON SOME MORPHOLOGICAL CHARACTERISTICS OF POTATO

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Abstract

Potato is a field crop which has a great significance in Bosnia and Herzegovina, however, the production is according to all indicators rather unstable and unreliable. Two-factorial trials were set up (of different combination of adsorbent and location) for examining the influence of location and super-adsorbents on morphological characteristicsof potato. The morphological characteristics monitored were as follows: plant height (cm) (measured from the ground surface to the top point of the plant); the number of sprouts; leaf surface per plant (m^2) with the help of leaf contour on paper method; new above-ground plant mass (g), leaf mass (g) and potato stem mass (g). The first factor consisted of 6 variants: control variant (A_0), superadsorbent (A_1), superadsorbent enriched with growth stimulants (A_2), superadsorbent enriched with microorganisms (A_3), superadsorbent enriched with microelements (A_4) and superadsorbent enriched with growth stimulants, microorganisms and microelements (A_5) in the quantity of 20 kg ha^{-1}. The trials were set up in East Sarajevo and Bijeljina. The main goal of this research was to determine the effect of super-adsorbent and area on morphological characteristics of potato. Through analysis of the results, it was determined that the use of different variants of adsorbent had great influence on the examined, while the influence of area had great significance for all the examined characteristics except for the number of stems per plant. The use of different variants of super-adsorbent in both areas had positive effect on morphological characteristics of potato, where the use of super-adsorbent enriched with growth stimulants, microorganisms and microelements is especially emphasised, while the variant in which super-adsorbents were not used (control variant) had poor results for the examined characteristics.

Key words: *superadsorbent, plant height, plant mass, assimilation surface area, stem number*.

CHEMICAL COMPOSITION OF THE FRUIT OF AUTOCHTHONOUS CULTIVARS OF APPLE FROM SARAJEVO AREA (BOSNIA AND HERZEGOVINA)

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Abstract

The paper presents the results of studying the chemical composition of the fruit of autochthonous cultivars of apple from Sarajevo area during an one–year period (2020. year). Determination found that it was the fruit of the next cultivars: Funtaca, Sadicka, Ticimka, Staklara and Car Konstantin. Significant differences were found between cultivars in content of soluble dry matter, total sugar, invert sugar, saccharose, total acids and pH value of the fruit of autochthonous cultivars. The cultivar of Staklara had the highest content of soluble dry matter, total sugar, invert sugar and pH value of fruit. The highest content of saccharose was in fruit of cultivar Sadicka, while the cultivar of Ticiminka had the highest content of total acids. Significant differences were found between cultivars in content of macroelements and microelements (magnesium, manganese, copper, aluminum, and zinc), but significant differences were not found between cultivars in content of trace elements (lead, cadmium, and arsenic). The cultivar Staklara had the highest content of magnesium, manganese, while the highest content of copper, aluminum and zinc was in the fruit of cultivar Car Konstantin. The fruits of autochthonous cultivars of apple had the same content of lead (0.10 mg/kg), cadmium (0.05 mg/kg) and arsenic (0.30 mg/kg). The analyzed autochthonous cultivars of apple from the Sarajevo area can be of great importance for integral and organic production, but also as a hybridization starting material to produce new, better cultivar resistant to pathogens of plant diseases and pests.

Key words: *apple, autochthonous cultivar, chemical composition, Sarajevo area.*

INFLUENCE OF THE SIZE OF VEGETATION SPACE ON THE QUALITY OF TOMATO SEEDLINGS

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Abstract

Tomato (*Lycopersicon esculentum* Mill.) is one of the most important vegetable species, which is result of its high nutritional value and the area on which it is grown. Tomatoes are mainly produced from seedlings and the quality of seedlings is one of the basic elements of achieving high yields. The quality of seedlings largely depends on the vegetation space, ie the size of the cells in the containers in which they are produced. Thus, the aim of this study was to examine the influence of vegetation space size on the quality of tomato seedlings grown in containers with different cell volumes. The study used a cv. Big Beef F1 which seedlings were produced in containers with 24, 40, 60 and 104 cells. As indicators of growth and quality of tomato seedlings the following parameters were analyzed: height and diameter of hypocotyl, length and width of cotyledons, number of leaves, length and width of leaves, height and diameter of stem and mass of whole plant, aboveground part and roots. The dynamics of seedling growth was directly dependent on the size of the vegetation space. The highest quality seedlings were obtained in containers with 24 cells, in which 4 leaves were formed, the height of the plant was 36.117 cm, and the weight of the whole plant was 14.24 g.

Keywords: *Tomato, Vegetation space, Seedling quality, Growth dynamic*.

IMPORTANCE OF BARLEY STEM RESERVES IN STRESS TOLERANCE

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Abstract

In most barley growing regions grain filling is subjected to several abiotic and biotic stresses. Grain filling often occurs when moisture supply is decreasing and temperaures are increasing. Foliar disease of barley also tends to spread and intensify towards and after flowering. The common end of all these stresses is the reduction grain weight, grain shriveling, reduced test weight and loss in yield. The current source of carbon for grain filling is assimilation by the light intercepting viable green surfaces. This source is normaččy diminishing due to natural senescence and the effect of various stresses. At the same time, the demand by the growing grain is increasing, in addition to the demand posed by maintenance respiration of the live plant biomass. Hence, an important source of carbon for grain filling is stem reserve.Even under mild conditions, current asimilation may be limited for normal grain filling. Twenty two-rowed barley varieties were tested during four year period for dry matter and nitrogen accumulation and translocationIn a year with favorable weather conditions 58% of dry matter was accumulated during pre-anthesis, while in a year with less favorable weather the amount was 48%. In the favorable year 91% and in unfavorable year 65% of nitrogen was accumulated until anthesis. Dry matter translocation efficiency depended on the genotype and ranged frpm 3 to 16.4%, while the contribution of pre-anthesis assimilates to grain varied from 4 to 24.2%. High positive correlation ($P<0.01$) were found between biomass at anthesis and biological yield, dry matter translocation efficiency, contribution of translocated dry matter to grain yield, and total plant nitrogen at maturity.

***Keywords**: Spring barley (Hordeum vulgare L.), dry matter, grain filling, translocation, pre-anthesis assimilates contribution.*

VASE LIFE OF CUT FLOWERS USING DIFFERENT VASE SOLUTION

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Abstract

The experiment was conducted in the laboratory for post-harvest treatment and pomology of the Faculty of Agriculture, University of Banja Luka, Bosnia and Herzegovina, during 2020. There were one cultivar of gerbera (*Gerbera jamesonii* 'Olympic Gold') and one cultivar of calla (*Zantedeschia aethiopica* 'Captain Ventura') used in this research. Preservative solutions Flower care (0.2%) and sucrose (2%) were used as vase solution to increase vase life of gerbera and calla. Average temperature in cold room, during the experiment was 9°C with relative humidity 65%, without additional light. Statistical data analysis determined a significantdifference in cut flower vase life depending on the vase solution. Vase life of cut gerbera flower kept in sucrose was 28 days (in changing solution) and 21 days (in permanent solution) on average, while vase life of cut gerbera flower kept in Flower care was 24 days (in changing solution) and 16 days (in permanent solution) on average. Vase life of cut calla flower kept in Flower care was 26 days (in changing solution) and 20 days (in permanent solution) on average, while vase life of cut calla flower kept in sucrose was 24 days (in changing solution) and 22 days (in permanent solution) on average. Transpiration intensity also depended on the solution for keeping flowers. The highest transpiration intensity was determined with cut flower which had the longest vase life and vice versa. The research indicates that the application of the preparation Flower care, which contains glucose, biocides and acidifiers, affects the viability of calla flower and prolongs the vase life. Also, the application of the preparation with sucrose prolongs the vase life of gerbera flower.

Keywords: *cut flower, vase life, Gerbera jamesonii, Zantedeschia aethiopica, Flower care, sucrose.*

GENETIC PARAMETERS AND SELECTION IN ELEPHANT GRASS FOR PRODUCTION AND QUALITY OF BIOMASS BY MIXED-MODELS

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Abstract

The aim of this study was to estimate genetic parameters for selection of elephant grass clones for production and quality of energy biomass by the mixed-models methodology (REML/BLUP) using 40 accessions of elephant-grass. The following traits were evaluated: dry matter yield (DMY) and percentages of ash, cellulose, lignin, acid detergent fiber, and neutral detergent fiber. A randomized block design with two replicates was adopted. Four harvests were performed in the central 1.5 m of the plots, discarding the borders. Genetic variability among individuals was observed for all evaluated traits. However, DMY and lignin showed the highest CV_{gi}%. Heritability values ranged from medium to high magnitude — with noteworthy results for DMY, cellulose, lignin, acid detergent fiber (ADF) and neutral detergent fiber (NDF) — and accuracy values were consequently expressive, indicating high genetic variability, precision at the identification, and the possibility of success in the selection of populations. Genotypes six (Pinda Giant) and 22 (Pinda Elephant) stood out for obtaining the highest genetic gains for cellulose, lignin, ADF, and NDF with the use of individual BLUP, and would thus certainly contribute to greater advances for these traits.

Keywords: *Energy biomass, heritability, genetic variability, REML / BLUP.*

ENERGY FOR DYNAMIC TEARING OF GYNOPHORS OF BULGARIAN PEANUT VARIETIES

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Abstract

The aim of the research is to determine the energy for dynamic detachment of the fruits of fifteen promising Bulgarian peanut varieties. It was determined that the value and nature of the energy change differ significantly for the studied varieties, but it predetermines scattering losses during the mechanized harvesting. The results shows different dynamics of change of energy for tearing off gynophore in different varieties. In some of them, it varies widely, at the expense of a slight decrease in humidity. In others, the energy changes in a narrower range with a more intensive decrease in the pods' humidity. The strengthening of the gynophore by lowering the moisture content in the fruits is an indicator for increasing the resistance of the beans to mechanical influences during the period of field ripening until reaching technological maturity. The most suitable variety of peanuts for mechanized harvesting is 539_mother. Its energy used to detach fruits from stems decreases with decreasing humidity and mass of the fruit. It reaches a maximum of 0.075 J at an average mass of 2 g and a moisture content of 10%. The results obtained can be used to determine the varieties which give the least scattering losses of peanut fruits at mechanized harvesting as well as in the selection varieties, suitable for mechanized harvesting.

Keywords: *Peanuts, Energy, Gynophors, Bulgarian.*

COMPARATIVE STUDY OF LETTUCE CULTIVARS UNDER OPEN FIELD PRODUCTION

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Abstract

On alluvial-meadow soil in conditions of field experience with spring cultivation, 19 varieties of head lettuce (*Lactuca sativa* var. *Capitata*) type Batavia (Batavia) were studied. The influence of soil and climatic conditions on the growth indicators and some of the indicators characterizing the quality of the production were established. According to the indicator mass of plants when harvested in the phase of technical maturity, lettuce plants were arranged in 9 homogeneous groups. The highest plant masses at the end of the study were reported in the varieties Funride-294.1 gr/plant and Florine-266.4 gr/plant or 46.6% and 32.8% larger than the average weight (200.6 gr/plant) for the experiment. At a confidence level of 95.0%, the experimental varieties were divided into 10 homogeneous groups according to the indicator number of leaves, as the variety Isi-45194 had the largest number - 54.4 leaves in its rosette. The measured nitrate content in the leaf mass of lettuce varieties was below the permitted concentrations for spring cultivation ranging between 277.6 mg NO3/kg fresh weight in the Hettie variety and 1248.0 mg NO3/kg and 1234.8 mg NO3 / kg in the varieties Satine and Kriska. The nitrate nitrogen content was also low - between 6.9% (Aquarel variety) and 19.9% (Satine variety).

Key words: *Lettuce, cultivars, maturity, nitrate contents and fresh weight.*

PLANT GENETIC RESOURCES IN BULGARIA – CONSERVATION AND UTILIZATION

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Abstract

The plant genetic resources (PGR) of Bulgaria are studied, maintained and stored mainly at the Institute for Plant Genetic Resources in Sadovo, where the National Gene Bank is also based. At the research centers of Agricultural Academy evaluation on feature collections necessary for the breeding of main agricultural crops has been carried out. At the botanic gardens and Universities collections of wild botanic species and relatives of cultivated crops are also maintained. The reliability of the data and evaluation of PGR requires complete inventory of the available plant genetic diversity in the country. An analysis has been made about inventory information and classification of the results on the main priority issues and activities. The available information has been analyzed and evaluated including activities and problems for PGR's preservation. The leading arguments and conclusions have been drawn from the research and activities carried out atthe IPGR in Sadovo, where the national *ex situ* collections from cultivated plants and their wild relatives are stored. Their study, conservation, maintenance and utilization have been accomplished according to the European standards. The aim of this paper is to present and to provide results at national level about the preservation of PGR, especially these of high importance for the conservation and sustainable development of the agriculture and ecology.

Keywords: *Plant Genetic Resources, Preservation, Conservation, Utilization.*

EFFECTS OF GAMMA-IRRADIATION ON OXIDATIVE STABILITY AND ANTIOXIDANT ACTIVITY OF WALNUTS

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Abstract

Gamma-irradiation at low doses is inexpensive, fast and widely used method for preservation of nuts, dried herbs, fruits, vegetable mixtures, meat and other types of food against pathogenic microorganisms in order to prolong the shelflife of products. Unfortunately, along with the positive effects of this treatment, highly reactive free radicals may be formed with toxic effects on various biological structures. Effective protection against such changes in molecules and tissues is provided by the antioxidants. Since walnuts worldwide are among the preferable nuts with significant health benefits the aim of our work was to investigate how a medium dose (10 kGy) of gamma-irradiation affects their oxidative stability and antioxidant activity. For the purpose, initially the lipid matrix was characterized by determination of kernels fat content, fatty acids composition and main tocopherols. Then, oxidative stability of the oil was measured by Induction periods of autoxidation at 80^{o}C, 100^{o}C and 120^{o}C, as well as by the amounts of conjugated dienes and trienes. On the other hand, defatted walnuts were analysed to estimate the content of total polyphenols and flavonoids as strong and important natural antioxidants. Antioxidant activity of that residue was quantified by ORAC and HORAC methods. Finally, antioxidant compositions from tocopherol and ascorbyl palmitate were tested for stabilisation of walnut oil against autoxidation. Comparison of results for non-irradiated and irradiated walnuts revealed that 10 kGy dose of gamma-irradiation did not change significantly the fat content and fatty acids composition of oil, as well as the total polyphenols and flavonoids amounts in defatted residue. On the other hand, irradiation induced increasing in conjugated dienes and trienes levels, decreasing in tocopherols and respectively, decreasing in induction periods. Slight decreasing in antioxidant activity of defatted residue was observed as well.

Keywords: *walnuts, gamma-irradiation, lipids, oxidative stability, antioxidants.*

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INFLUENCE OF DIFFERENT ROOTSTOCKS ON THE CONTENT OF BIOLOGICALLY ACTIVE COMPOUNDS IN PLUMS AND PEACHES

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Abstract

Balanced diets, including the regular consumption of fruits, play a major protective role against many diseases. Fruits are valuable sources of nutrients, vitamins, minerals, dietary fiber, nonessential phytochemicals, water, and especially an abundance of antioxidant compounds. The aim of this study was to evaluate the influence of different rootstocks on the accumulation of biologically active compounds in fruits. We compared the total phenolic, flavonoid, anthocyanins content and antioxidant capacity of methanolic extracts from fruit of plum cultivar "Cacanska Lepotica" grafted on five different rootstocks: Wavit, Janka, Ishtara, GF677 and GXN and peach cultivar "Redhaven" grafted on two rootstocks: GF677 and GXN, harvested in two consecutive years (2019 and 2020). The results showed that plums were greater in phenolic, flavonoids and anthocyanins content and better scavengers of DPPH free radicals, compared to peach extracts. A difference in the content of biologically active compounds in plum fruit extracts grown on different rootstocks was observed, as the richest was the extract of plum grafted on Wavit rootstock, and the poorest was that grown on Ishtara. The total phenolic content was almost two times higher in the extract from peaches grown on GF677 as compared to those grown on GXN. The flavonoids and anthocyanins contents in both peach samples were approximately the same. Plum and peach extracts from two consecutive years also showed some variations of the studied metabolites.

Keywords: *"Cacanska Lepotica","Redhaven", rootstock, phenolics, antioxidant potential.*

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INFLUENCE OF INTERCROPPING SWEET SORGHUM WITH CLIMBING BEAN ON FORAGE YIELD AND QUALITY

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Abstract

Cereals are highly important in feeding ruminant animals for their high dry matter production and low cost. Sweet sorghum is an important silage crop and has an increasing popularity because of the need for relatively smaller quantities of water per unit dry matter production compared to maize. Regarding to high feed costs of protein supplementations, legumes can be used in livestock nutrition for their high protein content and, thus, providing cost savings. Since legumes have low dry matter yield, acceptable forage yield and quality can be obtained from intercropping cereals and legumes compared with their sole crops. Sweet sorghum (*Sorghum bicolor* L.) and climbing bean (*Phaseolus vulgaris* L.) intercropped in different sowing densities and pure sweet sorghum crop were evaluated to determine the best intercropping system with respect to forage yield and quality. The highest dry matter yield was produced by SBPV3 (22.1 t ha^{-1}), and the lowest by solo sweet sorghum (18.4 t ha^{-1}). All intercrops had higher crude protein values in dry matter 95 g kg^{-1} for the SBPV1, 105 g kg^{-1} for the SBPV2 and 115 g kg^{-1} for the SBPV3, than the monocrop sweet sorghum (80 g kg^{-1} DM). Intercropping of sweet sorghum with climbing bean reduced neutral detergent fiber, resulting in increased forage digestibility. Therefore, sweet sorghum intercropping with climbing bean could substantially increase forage quantity and quality, and decrease requirements for protein supplements as compared with sole sweet sorghum.

Keywords: *Intercropping, Sweet Sorghum, Climbing Bean, Yield, Quality*

EFFECT OF FOLIAR SPRAY OF AMMONIUM NITRATE AND IRRIGATION TIME ON VEGETATIVE GROWTH, FRUIT SET, YIELD AND FRUIT QUALITY OF "EWAIS" MANGO TREES

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Abstract

The experiment was done during two seasons on 'Ewais' mango trees to study impact of spraying NH_4NO_3 and irrigation time on vegetative growth, yield and fruit quality. Experimental trees received same care including irrigation until the 1st week of Oct. where; the irrigation was adapted to applied 5m3/feddan(4200m2)/week to control leaves damage & the treatments: (T1) Water spraying at 1st week of Nov. + normal irrigation at the same time after 4 weeks of adapted irrigation (Control); (T2) Spraying with NH_4NO_3 2% at 1st week of Nov. + normal irrigation at the same time after 4 weeks of adapted irrigation; (T3) Spraying NH_4NO_3 2% at 1st week of Nov. + normal irrigation at 1st week of Dec. after 8 weeks of adapted irrigation; (T4) Spraying NH_4NO_3 2% at 1st week of Nov. + normal irrigation at 1st week of Jan. after 12 weeks of adapted irrigation. T2, T3 & T4 increased terminal shoot length, no. leaves/terminal shoots and leaf area which reflected on increase panicle length, width & no. secondary branches/panicle that increased fruit set & retention & yield and improved fruit quality not only physical properties i.e. fruit weight, dimensions, volume & specific gravity but also chemical components i.e. T.S.S.%, T.S.S / acid ratio and vitamin C compared to control, however the acidity decreased compared with control. Among all treatments, NH_4NO_3 2% at 1st week of Nov. + normal irrigation program at 1st week of Jan. after 12 weeks of adapted irrigation (T4) is recommended since; it had the superiority effect on studied parameters during two seasons.

Keywords: *Mango, foliar spray, water deficit, yield, fruit quality.*

CO-ADDITION OF POTASSIUM HUMATE AND VINASSE ENHANCES GROWTH AND YIELD IN "WONDERFUL" POMEGRANATE UNDER SANDY SOIL

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Abstract

"Wonderful" pomegranate is cultivated in large areas of sandy soil in Egypt and it products low yield and quality under these conditions. Soil applications of potassium humate and vinasse could effectively be used in sandy soil to enhance soil nutrient status as well as to increase growth and productivity. The trees were treated with soil application of potassium humate (10 g, 20 g, and 40 g per tree), vinasse (500 mL and 1000 mL) alone and in combinations to form 12 treatments including the control (water only). Result shows that potassium humate & vinasse alone and in combinations improved vegetative growth parameters i.e. shoot length, leaves number per shoot and leaf area due to their clear effect alone or in combination on increasing mineral leaf content that reflected on improving yield and fruit quality compared to control. Potassium humate & vinasse alone and in combinations have a great impact on improving not only the fruiting behavior *viz* perfect flower %, fruit set %, and productivity but also fruit quality for both fruit physical characteristics (such as fruit weight, aril/fruit %) and fruit chemical properties via TSS %. All of the abovementioned parameters were significantly higher in response to potassium humate and vinasse in combinations than individual application and all treatments resulted in significantly lower acidity compared to control. Among all treatments, soil application of 40g potassium humate plus 1000 mL vinasse is recommended since, it has a great influence on improving growth, yield and fruit quality of "Wonderful" pomegranate under sandy soil conditions.

Key words: *Potassium humate, Vinasse, Yield, Fruit quality, Pomegranate*.

EFFECT OF DIFFERENT WEED CONTROL PRACTICES ON YIELD OF SESAME CROP

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Abstract

Two field experiments were carried out at the Experimental Farm, Faculty of Agriculture, Fayoum University at Demo, Fayoum Governorate, Egypt, during the 2013 and 2014 growing seasons to study the effect of integration between two tillage systems (T_1 and T_2), two sesame cultivars ($V_1$and V_2) and six weed control treatments i.e., Hand Hoeing twice at 20 and 40 days after sowing DAS (C_1); pendimethalin 1l/fed., + one hand-weeding at 30 DAS(C_2); pendimethalin 1l/fed., (C_3); Celthodim1l/fed., (C_4);fluazifop-p-buty 1l/fed., (C_5); and unweeded (C_6) and their interaction, on growth, yield, as well as yield components of Sesame (*Sesamum indicum* L.) and its associated weeds. Results reviled that the efficiency of the applied weed management treatments against sesame weeds indicated that no treatments performed better than hand-hoeing twice (C_1) and pendimethalin 1l/fed., + one hand-weeding at 30 DAS(C_2) in both seasons. These potent treatments controlled 81.04- 58.37% in the 1st season and 91.40- 75.95 % in the 2nd one of the total fresh weeds. Pendimethalin 1l/fed., alone came in the second order and controlled 45.42 and 55.52% in both seasons, respectively. Hand-hoeing twice and pendimethalin + one hand-weeding were the potent practice for enhancing leaves number/plant, leaves fresh weight/plant (g), leaves dry weight/plant (g), stem fresh weight/plant (g), stem dry weight/plant (g) Number of capsules/plant, weight of capsules/plant (g), seed yield/plant (g), straw yield/plant (g) and 1000- Seed weight (g). Also these potent treatments increased percentage in seed yield compared with unweeded treatment by 884.5 and 516. 7 % in the 1st season, as well as 669.54 and 475.41 % in the 2nd season. Off the two applied herbicides, clethodim and fluazifop gave excellent control only for grassy weeds in the first season, but failed to secure satisfactory control efficiency on broad-leaved as well as total weeds,and thus gave a low yield compared to the rest of weed control treatments.

Key words: *Sesamum indicum, Tillage system, Hand-hoeing, weed management, pre-emergence, herbicide, weed control, crop yield.*

OPTIMISATION OF THE SUBSTRATE FOR THE CULTIVATION OF OYSTER MUSHROOMS (*PLEUROTUS OSTREATUS*) USING COFFEE GROUNDS AND BY-PRODUCT FROM BREWERIES

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Abstract

The study concerns the valorization of wheat straw, coffee grounds and brewery draff through the cultivation of edible mushrooms, *Pleurotus ostreatus*, the grey oyster mushroom. The aim is to determine the optimal composition of the substrate that will enable these agricultural residues and co-products of food processing to be used to their full potential by maximizing the yield of mushrooms. Different culture substrates were composed with different proportions, they were seeded with mycelium and the yields were compared. Statistical analysis was carried out and showed a slightly more positive correlation between the substrates composed of spent grain. However, the lack of repetitions of the experiment prevents significant results from being obtained to conclude. Another study carried out in 2020 also supported the fact that the substrate from coffee grounds can only be valorized by integrating it with straw because the density of the coffee grounds impacts the development of the mycelium. The results of these two years of research thus highlight the possibility of valorizing two by-products (coffee grounds and spent grain) without, reaching the yields obtained with a straw substrate from the literature. However, the results and choice of proportions should be consolidated with an experimental set-up and a series of repetitions.

Key words: *mushrooms, substrate, yield.*

SWEET POTATO ROOT SYSTEM UNDER VARIOUS CULTIVATION TECHNIQUES

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Abstract

Sweet potato production started a few years ago in central Europe. Due to the needs of the tropical plant, cultivation methods must be adapted to the shorter growing period in temperate climate. Quick and dense root growth contributes to rapid yield formation, but knowledge about sweet potato root system is poor. A field experiment was established to determine storage root yield and fibrous root growth under different cultivation methods. Rooted sweet potato seedlings (cv. „Beauregard“) were planted on potato ridges (row spacing: 75 cm), on asparagus ridges (row spacing: 200 cm) and flat beds in 2019 on a clayey fluvisol in southern Germany. The seedlings were planted at a plant density of 4 plants m^{-2} in beds and potato ridges and 2 plants m^{-2} in asparagus ridges. Weed control was done mechanically. Root distribution in soil was determined using the profile wall method in the three cultivation techniques before harvest in September. The results show that sweet potato roots prefer loose soil, while compacted soil structure reduced the root system. The highest root length was located next to the storage roots. About 90 % of the root length was found in the top soil, in deeper soil layers roots mainly followed earth worm channels. Sweet potato roots did not penetrate the soil between asparagus ridges adequately. In the flat beds and between the potato ridges, the root system was well developed. Further research is needed to clarify root growth in different soils and under different soil conditions.

Keywords: *Sweet Potato, Root System, Cultivation technique, Profile wall method.*

DEVELOPMENT OF A WEB-BASED FARM-NUTRIENT-MANAGEMENT-SYSTEM: REQUIREMENTS AND MODEL STRUCTURE

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Abstract

Reduction of nitrogen emissions like air pollution, leaching and runoff are major challenges in today's agriculture. To face these environmental problems various software tools have been provided to farmers, but in most cases they only focus on one specific topic. In the research project „Web-Man" a web-based nutrient-management-tool is developed, that takes into account all steps from fertilization planning, nutrient balancing up to nutrient loss modelling in one software system. Users of this system are supposed to be farmers, consultants and scientists. Therefore, the following requirements must be taken into account: Manual data input has to be reduced to a necessary minimum. Sufficient data protection and data security must be ensured. The user interface has to be designed intuitively. Legal framework conditions need to be taken into account when making fertilizer recommendations. Web-Man is modular, structured and therefore ready to meet different user demands. Additional to the farm model containing basic farm information, various other modules (e.g. tools for fertilization planning, nutrient balancing, humus balancing or nitrate leaching modelling) can be selected and used. For most of these modules there are different functional approaches depending on the complexity of the underlying algorithms. Usually there is one very simple approach with low data requirements and one or two more complex computations. Web-Man has to serve users with different demands and interests, but with its modular structure and intuitive user interface it will not overwhelm simple users and meet the needs of sophisticated users at the same time.

Keywords: *Software development, Nutrient management, nitrate leaching.*

INFLUENCE OF BLUE AND RED LEDs ON DEVELOPMENT AND NUTRITIVE VALUE OF *PERILLA FRUTESCENS* (L.) CULTIVATED IN CLIMATE CHAMBERS

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Abstract

In this study influence of supplemental blue and red LED lighting on growth, nutrient solution uptake and concentration of secondary metabolites was investigated. *Perilla* plants were cultivated in climate chambers, where main light was provided by fluorescent tubes with PPFD between 123-177 $\mu molm^{-2}s^{-1}$. Additionally, blue and red LEDs were used, providing 11 $\mu molm^{-2}s^{-1}$ or 12 $\mu molm^{-2}s^{-1}$, respectively. Temperature was set on 24/19°C (day/night), relative air humidity on 64/56% (day/night), and day length was 16 hours. Results showed that small portion of supplemental blue light (~9%) increased fresh mass (FM), dry mass (DM), and nutrient solution uptake (NSU) up to 50.33%, 10.85% or 31.80%, respectively. Supplemental red light (~6%) increased nutrient solution uptake up to 23.56%, while fresh and dry mass were higher than control, but without statistical significance. Regarding nutritive value of *Perilla*, supplemental blue light significantly increased carotenoid concentration (Car) (+13.37%), but polyphenols (PP), anthocyanins (Anth) and flavonoid (Fl) concentrations did not differ from the control. In treatment with supplemental red light, only flavonoid concentration was significantly increased (+14.34%). Use of supplemental blue or red LEDs in closed systems with controlled conditions increase or tends to increase plants fresh mass, dry mass, nutrient solution uptake rate, as well as concentration of some secondary metabolites.

Keywords: *Perilla, blue and red LEDs, climate chambers, growth and nutritive value.*

BREEDING MAIZE FOR ADAPTATION AT A LOW INPUT FARMING SYSTEM

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Abstract

Water and nutrients deficit could severely diminish productivity of maize (Zea mays L.), an important crop worldwide with increasing demand due to its multiple uses. Material of this study were 10 commercial hybrids, as well as three experimental open-pollinated lines obtained through breeding for plant yield efficiency in the absence of competition. Field experimentation was conducted in 2019 at the farm of the University of Western Macedonia in Florina (Northern Greece), under three regimes. The first regime was absence of competition (interplant distance 125 cm), according to the honeycomb R-13 design. Normal and low-input farmer regimesin terms of fertilization and irrigation were established in a split plot experiment as main plots. Agronomic and physiological traits were measured, i.e., plant height, cob height and length, flowering synchronization, grain yield, harvest index, chlorophyll content, chlorophyl fluorescence, net photosynthetic rate. Mostly affected traits were grain yield, anthesis-silking interval, chlorophyll content and the photosynthetic parameters. Compared to the hybrid meangrain yield, the three open-pollinated lines averaged ~84% in the absence of competition, as well as96 and 80% under the normal and low-input farmer conditions, respectively.In conclusion, the results provide a sign that breeding of open-pollinated lines performing comparatively to commercial hybrids is a realistic target.

Keywords: *Corn, Density, Fertilization, Water, Agronomic and physiological traits.*

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MANAGEMENT OF INTRA-CULTIVAR VARIATION IN COTTON

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Abstract

Greece is the main EU cotton (Gossypium sp.) producer and the modern requirements of growers and industry, as well as the needs of the ever-growing tertiary sector, require the creation of stable, well-adapted and highly productive varieties. The aim of this research is the investigation of exploitableintra-varietal genetic variability viaan innovative breeding approach. A field experiment was established in 2020 at the farm of the Aristotle University of Thessaloniki including 1,000 plants of a popular Greek variety according to the honey comb single-plant arrangement (a zig-zag allocation of widely separated equidistant individual plants to ensure absence of competition). Single-plant selection was based on plant morphological characteristics, yield and fiber quality, using an appropriate software constructed for this particular kind of experimentation and selection. More specifically, mass selection was implemented using three selection intensities to obtain the three corresponding advanced 'populations.' In the current season, these populations will be further evaluated under normal density, while nine of the best selected plants constituting first-generation sister lines will be tested in the absence of competition regime. Moreover, molecular markers will be used to verify the intra-variety genetic differentiation. This project is expected to provide important issues related to an efficient way of conservation breeding of elite cotton varieties aiming either to adapt them to the environmental uncertainty and enhance their longevity or to upgrade their genetic background towards higher productivity and stability.

Keywords: *Cotton, agronomic traits, yield, conservation breeding.*

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NITROGEN FERTILIZATION'S EFFECT ON THE QUALITY CHARACTERISTICS OF VARIOUS SORGHUM VARIETIES

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Abstract

Sorghum is a crop that belongs to the *Poaceae* family and is known for its high yields. A field experiment was conducted in the experimental farm of the University of Thessaly, (coordinates: latitude 39°24'50.95''N, longitude 22°44'0.79''E, altitude 78m ASL), to investigate the quality characteristics of six different sorghum varieties (V_1: Buffalo grain, V_2: Elite, V_3: Big Kahuna, V_4: 25K1009, V_5: 4264 and V_6: 5D61) under different nitrogen fertilization levels (N_1: 0, N_2: 80, N_3: 160 and N_4: 240 kg ha^{-1}, using urinary ammonia 40-0-0). There was used a factorial split-plot design with three replicates and twenty-four plots per replication, where the main factor was the different varieties and the sub-factor the different N-fertilization levels. The climate in the research region is typical of the Mediterranean. During summer months, the average recorded air temperature was 25.8°C and the recorded summer precipitation was just 46 mm. Protein content was not statistically significant different between the tested varieties but only between nitrogen levels with "Buffalo grain" being the variety with the higher protein content, while phosphorus and calcium content were statistically significant different between the tested varieties. Finally, ash, neutral detergent fiber and acid detergent fiber, was also statistically significant different between the tested varieties. The variety "5D61" was the one with higher ash content while the "Buffalo grain" variety lags statistically significantly behind all the others in both measured quality characteristics (neutral detergent fiber and acid detergent fiber).

Keywords: *Sorghum, protein, ash, ADF, NDF, nitrogen.*

THE EFFECT OF DIRECT USE OF LAKESIDE BIOMASSAS SOIL AMENDMENT ON THE PRODUCTIVITY OF DRY BEAN CROP

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Abstract

The riparian areas of the lake Mikri Prespa in the northwest of Greece are surrounded by extensive reedbeds (mainly *Phragmites australis* and *Typha angustifolia* reed) that spread around the perimeter of the lake. The removal of this vegetation is often problematic and imposes difficulties in management and costs. The goal of the present study was to evaluate the effect of the direct use of reed biomass on soil fertility and the performance of common bean (*Phaseolus vulgaris* L.) type "Plake", the main crop in the Prespa region. In a two year field experimentation we tested two fertilization methods, manure and chemical fertilization, combined with three reed biomass doses (0 as a control, 10 tn ha^{-1} and 20 tn ha^{-1}) resulting in five different reed addition treatments (0-0, 10-10, 10-0, 20-20 and 20-0 for the two consecutive yearsand each fertilization method respectively). Total chlorophyll content measured from start of flowering until physiological maturity was not affected by the incorporation of reed biomass in both fertilization methods. The chemical fertilization significantly affected bean yield exceeding the application of manure in all treatments of reed plant material addition. Reed plant addition treatments affected bean yield with all treatments showing higher values compared to the control (0-0) while the addition of 20 tn ha^{-1} for one year (20-0) significantly exceeded the control regardless of the fertilization method. Further research is needed to explore the best agricultural practice on the effect of reed addition on arable land improvement and the bean crop.

Keywords: *Common reed biomass, Soil amendment, Chlorophyll concentration, Bean yield, Prespa area.*

SELECTION AT ULTRA-LOW DENSITY OF SECOND GENERATION LINES OF BEAN CULTIVARS UNDER WATER STRESS

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Abstract

Selection in the absence of competition under ultra-low density has been proposed as a mean to develop new cultivars serving the needs of a sustainable agriculture under diverse climatic conditions. In 2018, individual high-yielding plants of the determinate type bean varieties (*Phaseolus vulgaris* L.) Iro and Pirgetos were selected in R21 honeycomb design trials under normal and deficit irrigation treatments. This led to 14 high-yielding second generation lines from cultivar Iro and four from cultivar Pirgetos which together with the original varieties were evaluated again in 2019 under the same ultra-low density and irrigation conditions. Water stress affected total chlorophyll content measured in selected individual plants from start of flowering until physiological maturity with some of the second generation lines showing similar or higher chlorophyll concentrations from the original varieties especially during the seed filling stage. Significant differences between normal and deficit irrigation were also shown on CO_2 assimilation rate for all genotypes, but there were no significant differences between the evaluated progenies and their respective ancestors. Compared to the original variety Iro, four of the second generation lines had similar or higher yield plant^{-1} (up to 15%) and exhibited the highest stability under both normal and water deficit conditions, whereas for the variety Pirgetos two progenies outperformed the original cultivar (by 5,5 to 27%). Further research is under way for a final evaluation of the selected progenies under farming density and water stress.

Keywords: *Ultra-low plant density, Water stress, Chlorophyll concentration, CO_2 assimilation rate.*

EVALUATION AND SELECTION OF MAIZE GENOTYPES WITHOUT COMPETITION

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Abstract

Maize (Zea mays L.) is an important crop forfood, feed and biofuel industries. However, crop yield variability due to climate change and scarcity of natural resources poses serious challenges to achieving food security. The evaluation and development of new genetic material with adaptation and increased yield at low input environments is more crucial than ever. For this reason, 10 commercial hybrids and three open pollinated lines were evaluated in a honey-comb R-13 experiment without competition in 2020 that was established at the farm of the University of Western Macedonia, in Florina, Northern Greece. The aim of this research was to assess the level of variation and inequality by measuring various agronomic (plant height, main cob height, cob length, yield etc.) and physiological (chlorophyll content, chlorophyll fluorescence, net photosynthetic rate, etc.) traits per plant. Also, mycorrhizal fungi from the rhizosphere of the plants were collected and evaluated. After manual harvesting, the yield was recorded, and the harvest index (HI) was estimated. The genotypes under evaluation differ statistically significant for most of the agronomic traits tested. However, no statistically significant differences were found for the physiological characteristics of the evaluated germplasm except from chlorophyll content ($P < 0.05$). Finally, genotypes that exhibited high yield potential, adaptability and stability of performance according to honeycomb methodology were identified.

Keywords: Competition, *Corn, Density, Honeycomb methodology, Agronomic and physiological characteristics.*

Acknowledgment: This research has been co-financed by the European Union and Greek national funds through the Operational Program Competitiveness, Entrepreneurship and Innovation, under the call RESEARCH – CREATE – INNOVATE (project code: T1EDK-00739).

IDENTIFICATION OF POPULATION-NEUTRAL MAIZE HYBRIDS USING PHYSIOLOGICAL TRAITS

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Abstract

Yield potential in maize (*Zea mays* L.) varies across environments and the same applies for the optimum population. Maize hybrids usually fail to meet the requirements of the diversified environments due to their capacity to attain yield potential at a particular population, resulting in yielding penalty. This makes most of the modern hybrids, population–depended. The aim of this research wasto recognize population-neutral hybrids, beginning from the evaluation of inbred lines and their hybrids for drought stress at the single plant level and normal density, using physiological traits. Four (4) inbred lines, five (5) hybrids-crosses of the inbred lines and one commercial check (AM720), were tested at well-watered and water-stressed conditions during the 2016 and 2017 growing season. The over-year and over-location analysis showed an average decrease of 40% in grain yield with the greater reduce to have the commercial check AM720, while the best performance in yield losses had line 26 and hybrid 26X30. Line 26 was selected and bred under ultra-low density with the use of the honeycomb selection method. Water Use Efficiency (WUE), stomatal conductance (c_i), evapotranspiration rate (E) and net photosynthesis (A_n) were strongly correlated with grain yield at the R2 growing stage (0.54**, 0.65**, 0.62** and 0.64** respectively) in contrast with the V10 growing stage where no significant correlation was observed (0.06, 0.02, 0.03, and 0.09 respectively). Chlorophyll meter readings were highly correlated with grain yield at R1 (0.60**) and R2 (0.62**) growing stages. It is clear that SPAD values and WUE, that have higher heritability than yield components, could be used additionally in the selection of maize genotypesintended for unstable growing conditions.

Keywords: *Ultra-low plant density, Water stress, Chlorophyll concentration, Water use efficiency.*

GRAIN QUALITY OF OPEN-POLLINATED MAIZE LINES AND HYBRIDS UNDER DROUGHT

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Abstract

Maize (*Zea mays* L.) kernel provides feed, food, and a resource for many unique industrial and commercial products. The grain quality of maize may decline due to breeding for increased yield. Our aim was to compare genotypes with different genetic background about the composition of their kernels for oil, starch and protein under different water and nutrition supplies. Field experimentation was conducted in 2020 at the farm of the University of Western Macedonia in Florina (Northern Greece). Normal and low-input farmer regimes in terms of fertilization and irrigation were established in a split plot experiment as main plots and 12 genotypes (10 hybrids and 2 open-pollinated lines) as sub-plots. Grain composition (oil, protein, starch) was measured by Infratec 1241 Grain Analyzer from FOSS Analytical company, based in NIT (Near Infrared Transmittance) technology. Were observed significant differences between the genotypes for all the three components. For the oil content, the two open-pollinated lines had an average performance between the genotypes (3,75 and 3,85%), with values to be from 3,55 (hybrid 8) to 4,4% (hybrid 6). About protein, line 11 had the higher value across the genotypes (9,72%) and the hybrid with code 8 the minimum (8,75%). For starch, hybrid 10 had the lower value 68,42% and line 12 the maximum, 70,92%. The treatment with low-input regimes reduced the grain yield by 15% in average, but did not affect statistically any of the grain quality components.

Keywords: Extractable starch, Oil concentration, Protein concentration, Low-input farming.

Acknowledgment: This research has been co-financed by the European Union and Greek national funds through the Operational Program Competitiveness, Entrepreneurship and Innovation, under the call RESEARCH – CREATE – INNOVATE (project code: T1EDK-00739).

GRAIN QUALITY OF OPEN-POLLINATED MAIZE LINES AND HYBRIDS UNDER DROUGHT

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Abstract

Maize (*Zea mays* L.) kernel provides feed, food, and a resource for many unique industrial and commercial products. The grain quality of maize may decline due to breeding for increased yield. Our aim was to compare genotypes with different genetic background about the composition of their kernels for oil, starch and protein under different water and nutrition supplies. Field experimentation was conducted in 2020 at the farm of the University of Western Macedonia in Florina (Northern Greece). Normal and low-input farmer regimes in terms of fertilization and irrigation were established in a split plot experiment as main plots and 12 genotypes (10 hybrids and 2 open-pollinated lines) as sub-plots. Grain composition (oil, protein, starch) was measured by Infratec 1241 Grain Analyzer from FOSS Analytical company, based in NIT (Near Infrared Transmittance) technology. Were observed significant differences between the genotypes for all the three components. For the oil content, the two open-pollinated lines had an average performance between the genotypes (3,75 and 3,85%), with values to be from 3,55 (hybrid 8) to 4,4% (hybrid 6). About protein, line 11 had the higher value across the genotypes (9,72%) and the hybrid with code 8 the minimum (8,75%). For starch, hybrid 10 had the lower value 68,42% and line 12 the maximum, 70,92%. The treatment with low-input regimes reduced the grain yield by 15% in average, but did not affect statistically any of the grain quality components.

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SELECTING MAIZE GENOTYPES UNDER TWO INPUT SYSTEMS BASED ON PHYSIOLOGICAL TRAITS AND SEED YIELD

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Abstract

Maize (Zea mays L.) is cultivated globally because of its wide climatic adaptability and multiple uses. The major constraints to maize production are abiotic stresses such as drought and low soil fertility that is nowadays aggravated due to extreme weather fluctuations. Therefore, it is crucial to identify and understand the key mechanisms that confer adaptability to maize germplasm and to develop high-yielding and climate-resilient cultivars. For that reason, 11 commercial hybrids and two open pollinated lines were evaluated in 2020. The experiment was a split-plot design with two input regimes (normal and low density, irrigation and fertilization) that was established in two locations in Northern Greece (farm of University of Western Macedonia, in Florina and farm of Democritus University in Orestiada). In order to evaluate the performance of the genotypes, specific physiological measurements (stomatal conductivity, photosynthetic rate, chlorophyll content and chlorophyll fluorescence) and their final seed yield were recorded in selected plants from all genotypes in both experimental fields. Furthermore, all the correlation coefficients between yield and physiological traits were estimated. The results of this research could assist in the selection of physiological traits that will be used in key field phenotyping protocols for maize with emphasis on low irrigation and fertilization conditions.

Keywords: C*orn, Hybrids, Open pollination lines, Physiological traits, Yield, Low input conditions.*

Acknowledgment: This research has been co-financed by the European Union and Greek national funds through the Operational Program Competitiveness, Entrepreneurship and Innovation, under the call RESEARCH – CREATE – INNOVATE (project code: T1EDK-00739).

EVALUATION OF GREEK RYE (*SECALE CEREALE* L.) ACCESSIONS

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Abstract

The cultivation area of rye (*Secale cereale* L.) was reduced significantly during the last four decades in Greece due to its replacement as a feed with other cereals or the critical reduction of livestock such as horses, donkeys, molars, etc. However, there is an increasing interest in rye cultivation in Greece and Europe due to its beneficial effects on human health from its consumption. In Greece, mainly local populations are the primary cultivars cultivated due to their high adaptability to local climatic conditions. The lack of a breeding project for rye in Greece in the last 30 years was the main reason to start our project aiming to evaluate 23 indigenous rye populations derived from the Hellenic Gene Bank. In December 2020 at the farm of the University of Western Macedonia in Florina, northwest of Greece an experiment was established in a randomized complete block design with three replications. The rye populations were evaluated for agronomical (days to ear emergence, plant height at maturity, length of spikes and awns at maturity, number of spikelets per spike, 1000 grain weight, yield), physiological (leaf chlorophyll concentration, chlorophyll fluorescence), and quality (protein content) characteristics. The study showed a significant variation between the rye populations for many important agronomical and quality traits. Finally, the experimentation revealed some promising populations which could be used as a starting genetic material or in crosses for a breeding project in Greece.

Keywords: *Rye, Secale cereale, Genetic variation, Local populations, Agronomic evaluation.*

PHOSPHORUS FERTILIZATION EFFECT ON *VICIA FABA*YIELD AND PROTEIN CONTENT

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Abstract

Beans (*Vicia faba*) are a protein-rich food and can be sown in early winter as well as in spring, providing flexibility depending on climatic conditions, soil type and cultivation systems. The micro-sperm bean which is usually used as animal feed is an important legume crop. It was decided to investigate the effect of phosphate fertilization on both seed yield and protein content because the plant performed well even in barren or depleted lands. For the purposes of the study, a field experiment was conducted in the experimental farm of the University of Thessaly (latitude 39°24'50.95''N, longitude 22°44'0.79''E, altitude 78m ASL), using a complete randomized block experimental design with four treatments (F1: control, F2: 30, F3: 60 and F4:90 kg ha^{-1} P_2O_5) and four replications. The soil in the experimental field was clayey and fertile, with 2.91 percent organic matter at a depth of 0 - 30 cm and 1.86 percent at a depth of 30 - 60 cm. Even in such a high-organic-matter soil, it was found that adding phosphorus enhanced seed yield, at the treatment of 90 kg ha^{-1} P_2O_5 having a statistically significant superiority, suggesting the need to add this macronutrient to micro-sperm beans growth. There was no difference in the protein content of the bean seeds across the different phosphate fertilization levels, while the protein content was found to be around 26% in all cases.

Keywords: *Bean, yield, protein, fertilization, phosphorus.*

COMPARISON OF TWO COMMERCIAL KITS FOR *ZEA MAYS* ROOT DNA EXTRACTION

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Abstract

Plant tissue from many cultivated species, such as cereals, contain polysaccharides, tannins, polyphenols and a variety of secondary metabolites. Moreover, plant roots are metabolically constitutively active and thus rich in bioactive phytochemicals, among which polyphenols are one of the most important categories. These substances could interfere with the DNA isolation process, where high purity and quality are required. In fact, DNA isolation protocols should be selected not only based on plant species, but also on tissue due to the presence of secondary metabolites. The extraction of high-quality plant DNA on a big scale is laborious, time consuming and expensive due to multiple steps and the high cost of liquid nitrogen, while the drawbacks derived from the available commercial kits are their high cost and low yield. The objective of this study was to compare maize root DNA yield between two commercial plant DNA extraction kits. The experiment took place in the Faculty of Agricultural Development of the Democritus University of Thrace in Orestiada. Maize plants grown in pots for 50 days were uprooted and DNA was isolated from root tissue with two different DNA extraction commercial protocols. Agarose gel electrophoresis was performed to check DNA purity and quality which were also determined using a photometer. Results show that the concentration of the isolated DNA did not demonstrate significant difference between the two protocols, whereas significant differences in the purity of DNA in question were observed.

Key Words: *root DNA extraction, Zea mays, commercial kit.*

THE EFFECT OF BIOSTIMULANT APPLICATION ON LETTUCE GROWTH PARAMETERS

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Abstract

Biostimulant application is an innovative and ecofriendly agronomic practice with increasing interest in horticultural production. In the present manuscript, five biostimulant products (e.g. seaweed extracts+macronutrients; humic and fulvic acids; Si+Ca+Zn; Si; amino acids) were tested on two pot-grown lettuce cultivars (Romaine type: cv. Doris; Batavia type: cv. Manchester) aiming to evaluate the effects on plant growth parameters (plant height; SPAD index; total plant weight number of leaves; fresh and dry weight of leaves; leaf area; specific leaf area). A varied effect of biostimulant treatment was observed on SPAD index and plant height in the case of Romaine lettuce, while the combination of Si+Ca+Zn and Si increased SPAD index and plant height in Batavia lettuce, respectively. Regarding plant growth parameters of Romaine lettuce, seaweed extract had a beneficial effect on total plant weight, weight of leaves and leaf area, while humic and fulvic acids increased the number of leaves, Si+Ca+Zn increased dry matter content of leaves and Si resulted to the highest specific leaf area. In the case of Batavia, the application of Si+Ca+Zn had the most beneficial effect on the tested growth parameters, except for the case of dry matter content of leaves which was the highest when plants were treated with seaweed extracts. Our results indicate positive effects of biostimulants on lettuce plant growth. However, a varied response was observed depending on the biostimulant product, especially in the case of Romaine lettuce. On the other hand, the combination of Si+Ca+Zn improved most of the growth parameters in Batavia type.

Key words: *Lactuca sativa, seaweed extracts, humic and fulvic acids, silicon, aminoacids.*

Acknowledgments: This research has been co-financed by the European Regional Development Fund of the European Union and Greek national funds through the Operational Program Competitiveness, Entrepreneurship and Innovation, under the call RESEARCH – CREATE – INNOVATE (project code: T2EDK-05281).

RESPONSE OF PUMPKIN GENOTYPES TO DROUGHT STRESS AT GERMINATION STAGE

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Abstract

Drought is one of the most severe environmental stressors affecting a wide range of crops, thus placing adaptation to water deficit conditions in the core of breeding activities. Given that germination is the most critical phase in the plant growth cycle, this study aimed atevaluating the seed germination and seedling growth potential under drought conditions as a screening approach to identify tolerant pumpkin germplasm at early growth stages. The genetic material consisted of seve npumpkin genotypes, including two commercial varieties (Fytro FS 243 and Big Max) and five local landraces (1, 2, 3, 4, 5), which adaptation to adverse climatic conditions has not been elucidated. Drought stress was induced by adding D-mannitol at three concentrations (100, 200 and 300 mM), while non-stressed plants were used as controls. Drought tolerance was assessed on the basis of germination percentage, seed water absorbance, seedling water content, shoot and root length, seedling vigor index and number of seedlings with abnormal genotype. Drought stress severely affected all traits associated with germination and seedling growth in a genotype dependent manner. Overall findings pointed to the superiority of landraces 2 and 5, while landraces 1 and 4 proved the most sensitive genotypes. Further, this study highlights the possibility of using this methodology for revealing the existing genetic variation in pumpkin germplasm of unknown tolerance to drought stress, preferably employing seedling vigor index as the main screening criterion at early growth stages,t hus upgrading the efficiency of breeding activities targeted at achieving drought tolerance inpumpkin.

Key words: *pumpkin, abiotic stress, drought stress, D-mannitol, screening for drought tolerance.*

Funding: This work was funded by the General Secretariat for Research and Technology of Greece and PRIMA foundation under the project PULPING (Prima2019-08).

GERMINATION PROFILING OF PUMPKIN GENOTYPES UNDER SALINITY STRESS

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Abstract

Salinity is one of the most limiting environmental stressors, causing adverse effects on plant growth, development and productivity worldwide. Given that vegetable crops, including pumpkin, are relatively sensitive to increased salinity, the identification of salt-tolerant cultivars is the most substantial means to enhance productivity in saline soils. This study aimed at investigating the response of selected pumpkin germplasm to salinity stress at germination stage. Seven pumpkin genotypes, including two commercial varieties (Fytro FS 243 and Big Max) and five local landraces (1, 2, 3, 4, 5), were screened for salt tolerance on the basis of seed germination and seedling growth potential under salt stress conditions (0, 100, 200 and 300 mMNaCl). Evaluation of tolerance was based on germination percentage, seed water absorbance, root and shoot length, seedling water content, seedling vigor index and number of seedlings with abnormal phenotype. Data were separately analyzed by ANOVA, combining NaCl concentrations and genotypes, while differences between means were compared by the LSD test ($p \leq 0.05$). Salinity stress affected all traits associated with germination and seedling growth, with varied effects depending on the stress level applied. However, genotypes differed significantly in their response to the varying salinity levels, thus indicating the existence of considerable genetic variation related to salt tolerance at germination stage. In this context, landrace 2 proved the most salt-tolerant genotype. Overall findings, underline the feasibility to employ such screening approach for the selection of salt tolerant pumpkin germplasm for cultivation in saline soils or exploitation as valuable breeding material.

Key words: *pumpkin, abiotic stress, salinity stress, NaCl, screening for salt tolerance.*

Acknowledgments: This work was funded by the General Secretariat for Research and Technology of Greece and PRIMA foundation under the project PULPING (Prima2019-08).

THE EFFECT OF FERTILIZATION REGIME ON *SCOLYMUS HISPANICUS* PLANT GROWTH

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Abstract

In the present study, different fertilization regimes were evaluated aiming to establish cultivation protocols for the commercial cultivation of the species. Seven fertilization treatments varying in amounts of N:P:K(namely, 100:100:100; 200:100:100; 200:200:200; 300:100:100; 300:200:200; 300:300:300 ppm on N:P:K and control where no fertilizers were added) were applied via nutrient solution feeding in pot-grown golden thistle plants. The growth parameters tested included the measurement of number of leaves, the fresh and dry weight of leaves, SPAD index, leaf area and specific leaf area, while net photosynthesis (Pn) at different light intensities (PAR:0-1300 $\mu mol \cdot s^{-1} \cdot m^{-2}$) was also recorded. Pn did not differ among the tested fertilization regimes, while a gradual increase was observed with increasing light intensity. Regarding the growth parameters, the highest number of leaves was recorded for the 300:100:100 treatment, while the highest fresh weigh and lowest dry weigh of leaves were observed in the treatment of 300:200:200. Moreover, a negative effect on fresh weight of leaves was observed in the case of 300:300:300 treatment. The highest leaf area was recorded in 300:100:100 and 100:100:100 treatments, whereas specific leaf area increased at 300:100:100 and 300:200:200 treatments being significantly different only from the control treatment. Similarly, no significant differences were observed in SPAD index between the fertilization treatments, whereas the control treatment recorded the lowest overall value. In conclusion, the application of fertilizers on *S. hispanicus* had positive effects on plant growth and visual appearance, especially the 300:200:200 treatment where increasing trends of fresh yield were recorded.

Key words: *golden thistle, wild edible greens, leaf area, SPAD index, nutrient solution.*

Acknowledgments: This work was funded by the General Secretariat for Research and Technology of Greece and PRIMA foundation under the project Valuefarm (Prima 2019-11).

SILAGE YIELD AND PROTEIN CONTENT OF FORAGE LEGUMES INTERCROPPING WITH CEREALS IN TWO SPATIAL ARRANGEMENTS

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Abstract

Intercropping of most annual legumes with winter cereals is a very common practice for forage production in many countries. The aim of this study was to determine the effect of different spatial arrangements of intercropping cereals with forage legumes on silage yield and protein content. The completely randomized design was applied with three replications. Particularly, common vetch and forage pea were used as forage legumes, and barley, and triticale were used as cereals, which were grown individually as well as intercropped with each other in mixed rows in a sowing ratio 65:35 or in alternate rows. The plants were harvested when the legumes were at the end of the flowering period and were separated by hand to determine the weight of fresh matter for each species. Samples of 100 g of hay from each experimental plot were used to calculate the dry matter and to determine the total N and subsequently the total protein content using the Kjeldahl method. In most cases differences were found between the treatments concerning the dry matter and the protein content. Regarding the fresh weight, the mixtures triticale+ common vetch (alternate rows), barley + common vetch (alternate rows) and barley+ forage pea (alternate rows) showed the higher yield. The forage pea gave the higher yield among the nonocrops. Regarding the dry weight, the mixtures barley+ forage pea (alternate rows) and triticale+ common vetch (alternate rows) showed the higher yield. Additionally, significant differences were recorded between the examined genotypes in grain yield. The barley intercropped with forage pea (mixed rows) gave the higher yield. Regarding the grain yield of legumes, common vetch intercropped with barley (alternate rows) and forage pea intercropped with barley (both cases) gave the higher yield. In all cases the forage yield (weight of dry matter) was higher in separated lines compared to mixed lines. However, concerning the grain yield the mixed rows were probably more productive.

Key words: *intercropping, dry matter, protein content, spatial arrangement.*

EVALUATION OF GREEK BREAD AND DURUM WHEAT CULTIVARS FOR DROUGHT TOLERANCEUSING POLYETHYLENE GLYCOL

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Abstract

In order to study the effect of drought stress seven bread wheat (*Triticum aestivum* L.) cultivars (Acheloos, Apolonia, Generoso, Doirani, Nestos, Strimonas, and Orpheas) and seven durum wheat (*Triticum durum* L.) cultivars (Sifnos, Anna, Elpida, Thraki, Papadakis, Athos, Mexikali 81) were evaluated at three levels of drought treatment using polyethylene glycol in a randomized complete block design with 10 replications. For this purpose, seedlings of the aforementioned genotypes were cultured in pots with three different concentrations of polyethylene glycol (5, 10% and 15% PEG 8000) whereas irrigation without PEG was used as control. During the experiment, the length of spike with awns, the length of spike, the plants height, the number of tillering per plant, and the concentration of proline in the plants treated were measured. The drought treatment reduced the length of spike and the plant height of the cultivars studied, whereas it increased the length of spike with awns in bread wheat cultivars. It was concluded that there are considerable differences in drought resistance between the genotypes studied. The drought stress, caused by the polyethylene glycol, increased the concentration of proline in the cultivars tested. The highest value of proline was estimated in plants of bread wheat cultivar Strimonas and in plants of durum wheat cultivar Sifnos so consequently, we can conclude that Strimonas and Sifnos were the most tolerant cultivars of the two species. Orpheas (bread wheat) and Thraki (durum wheat) had the lowest concentration of proline, so Orpheas and Thraki were considered the most sensitive cultivars.

Keywords: *drought stress, tolerance, polyethylene glycol, proline.*

PEANUT RESPONSE TO PLANTING PATTERN AND ROW SPACING

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Abstract

Peanuts are grown commercially in several Greek regions such as Messinia and Serres. The total cropping area in Greece is around 4500 hectares. However, many farmers have started to grow peanuts at the region of Thessaly and especially at the area of Trikala where the soil texture is medium. Because of the high farmers' interest in growing peanuts in Greece, an experiment carried out at the research farm of the University of Thessaly in Larissa to study peanut response to planting patterns and row spacing. The experiment included four different treatments of planting patterns and row spacing and three replicates of each treatment. Specifically, at the first treatment (control), peanuts were planted 75 cm apart along the rows. At the second treatment, there were twin rows 10 cm apart and the planting spacing was 75 cm along the rows. At the third treatment, there were four rows 50 cm apart and the planting spacing was 75 cm along the rows while at the fourth treatment, peanuts were planted on beds with planting spacing 75 cm along the beds. Peanuts grew in experimental plots of 5 m long, 3 m wide and 1 m apart. The results showed that the yields of the second and fourth treatment were significantly higher by 41.8% and 37% respectively than the yield of the controller. The yield of the third treatment was also higher (no significantly) by 11.2% than the controller. All the above indicate that the use of twin rows of peanuts increases peanut yield because of the use of the double number of seeds compared to the control treatment. However, planting peanuts on beds seems to be an inexpensive solution considering the loamy sand soil type of the peanut plots.

Keywords: *beds, twin rows, yield, soil properties, evapotranspiration, fertilizers.*

COMPARISON COMPOSITION OF LAVENDER AND LAVANDIN VOLATILES CULTIVATED IN KASHMIR HIMALAYAS WHICH HAVE POTENTIAL TO BE VERSATILE INDUSTRIAL CROPS OF THE REGION

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Abstract

Species of Lavender have a commanding position in essential oil and pharmaceutical industry among the aroma bearing plants. Lavender oil has been the subject of numerous studies over the years and detailed chemical analysis from various parts of the world has been carried out. True lavender (*Lavendula angustifolia*) and lavandin (*Lavendula X intermedia*) have been cultivated for essential oil in Kashmir Himalayas. The main constituents of oil identified by GC and MS analysis are 25 compounds in Lavandin and 50 compounds in Lavender. The main constituents in lavandin are: Linalool (32.18%), Camphor (16.33), Linalyl acetate (8.29), 1,8- Cineole (2.79) and α- pinene (1.67), while the main constituents in true lavender are 25.75% of linalool, 44.98% linalyal acetate, 1.49% of terpineol, 2.7% of borneol, 1.07% of camphor, 3,44% oflavandulyl acetate, 1.85% of caryophyllene, 2.08% of caryophyllene oxide etc. Linalool, the important pharmaceutical compound, is present more in Lavandin than in Lavender, but camphor content in lavandin is high. The constituents found in the Lavandula spp. of Kashmir Himalayas are of international standards when compared with those cultivated elsewhere in the world. The constituents are as per the range given by European Pharmacopoeia.Preferably linalool should be 20-45 %, linalylacetate 25 - 46 % and camphor to be less than 1.2 % of in lavender oil.

Key words: *Lavandin, Lavender, Lavendula angustifolia, Lavendula X intermedia, Linalool, Linalyal acetate.*

EFFECT OF HUMIC ACID AND FULVIC ACID ON THE YIELD AND SUGAR YIELD OF SUGAR BEET

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Abstract

Humic acid and Fulvic acid, as organic acids derived from humus and other natural sources, increase hormonal effects and improve the absorption of nutrients, increasing the root and organ biomass. In order to investigate the effect of Humic acid and Fulvic acid on yield and quality of sugar beet, a factorial experiment was conducted in a randomized complete block design in Rabat Qarehbil district of North Khorasan in 2015. This experiment was performed in three replicates on a sugar beet monogerms (Bridgita). The treatments consisted of 4 levels of Humic acid: 0 (control treatment), 20, 40 and 60 kg ha-1 and 4 levels of Fulvic acid: 0 (control treatment), 2, 4 and 6 kg / ha. The results showed that Humic acid significantly increased root yield. But Fulvic acid had no significant effect on this trait. The highest root yield (50.32 t ha-1) and the highest sugar yield (9.43 t / ha) were obtained in 60 kg ha-1 Humic acid. And treatment of 40 kg ha-1 Humic acid with 8.53 t ha-1 had the highest white sugar yield. The highest root and sugar yield was obtained in treatment of 6 kg ha-1 of Fulvic acid. The interactions of two treatments on the most traits were significant.

Key words: *Humic acid, Fulivic acid, Sugar beet.*

GROWTH PARAMETER RESPONSE OF QUINOA TO NITROGEN FERTILIZER UNDER HIGH SALINITY LEVELS

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Abstract

Soil salinity is the serious problem of agricultural land in arid and semi-arid regions and reducing the yield of most crops more than 50%. One of the strategies for crop production in saline areas is the use of halophyte plants. Quinoa (*Chenopodium quinoa* Willd) is a halophyte species that have a very high tolerance to salinity. By increasing soil salinity and low research on the effect of salinity on quinoa plant, this study was conducted to investigate the effect of nitrogen consumption under salinity on growth parameters of quinoa. A greenhouse experiment was conducted as a factorial, designed in a randomized complete block with three replications. Treatment e included salinity (100, 200, 300, 400, 500 mM) and nitrogen (50, 100, 150 and 200 ppm). Traits that were measured included leaf area, plant height, stem diameter and chlorophyll index. Results indicated that leaf area, plant height, and stem diameter affected by nitrogen and salinity levels, interaction effect of salinity and nitrogen application had non-significant effect on these traits. Chlorophyll index was affected by salinity levels. Mean comparison indicated that by increasing nitrogen concentration in nutrient solution to 150 ppm, leaf area and plant height increased. The highest stem diameter was observed by increasing nitrogen levels to 200 ppm. By increasing salinity levels to 300 mM leaf area, plant height, and chlorophyll index significantly decreased and the lowest stem diameter was observed in 400Mm salinity. Results of this study indicate positive effect of nitrogen high concentrations on quinoa and this plant can tolerate salinity high levels.

Key words: *Leaf area, Nitrogen, Quinoa, Stem diameter.*

COMPARISION OF THE EFFECT OF BIO AND NON-BIO-FERTILIZERS ON YIELD AND ESSENTIAL OIL OF *THYMUS VULGARIS* L.

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Abstract

Since the global approach to the production of medicinal plants is effective in improving the quantity and quality of the material, it seems that the nutrition of these plants through the use of biological fertilizers in different environmental conditions is most in line with the production goals of medicinal plants. Therefore, in order to investigate the effect of biofertilizers and non-biofertilizers on biological yield, flowering branches and thyme essential oil (*Thymus vulgaris* L.), an experiment in a randomized complete block design with 4 replications in a farm in central Yazd, Iran in the crop year 2019 was done. Biofertilizers and non-biofertilizers in five levels including: Control (without fertilizer application), Endomycorrhiza fungi of the genus Glomus (*Glomus mosseae, G. intraradics*, *G. etunicatum*), *Azospirillum brasilense*, *Pseudomonas fluorescens* and NPK , were considered as experimental factors. The results of analysis of variance showed that fertilizer treatment had a significant effect on biological yield, flowering branches and thyme essential oil. Mycorrhiza had the greatest effect on biological yield (163%), yield of flowering branches (105%) and essential oil yield (87%) compared to the control. Therefore, the use of biofertilizers, especially mycorrhiza fertilizer, which can greatly increase the yield and amount of active ingredient, is recommended in this plant.

Keywords: *Mycorrhiza, Yield, Essential oil, Thyme.*

THE GENETIC DIVERSITY AND MOLECULAR MAPPING OF ROOT TRAITS IN DURUM WHEAT

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Abstract

Durum wheat (*Triticum turgidum L. var. durum, 2n = 4x = 28*) is one of the most important crop for the agriculture and economy of Mediterranean countries. Understanding the genetic diversity and the genotype population structure based on molecular markers at the genome level can speed up the utilization of diverse genetic resources for varietal improvement. In the present study, the association mapping (AM) strategy based on a panel of 183 elite accessions from different durum wheat growing regions of Mediterranean countries (Italy, Morocco, Spain, Syria, and Tunisia), Southwestern USA and Mexico and also a population of 176 recombinant inbred lines (RILs) derived from the cross between two Italian elite durum wheat cvs. Meridiana and Claudio, were deployed in order to identify QTLs for root traits and compare their overlaps with other QTLs identified. The panel was profiled with simple sequence repeat, Diversity Arrays Technology and sequence-tagged site markers. The genetic relationships among the accessions have been investigated using both a genetic-similarity and a model-based Bayesian clustering method. Significant differences among genotypes were observed for all measured root traits. In this direction, our study enabled us to map two major QTLs controlling seminal root angle on chromosomes 4B and 6B. For these two QTLs, along with others, we provided molecular markers associated to the favorable allele.

Keywords: *Durum wheat, QTL, molecular mapping*

THE EFFECT OF *PSEUDOMONAS SP* AND *SERRATIA MARCESCENS* ON THE ALTERATION OF SEPIOLITE UNDER SALINITY STRESS

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Abstract

As limited research has been conducted on the effect of soil bacteria on the weathering of sepiolitein plant root environment, the present study aimed to investigate the efficiency of silicate solubilizing bacteria in the release of elements from sepiolite, under salinity stress in the roots of pistachio seedlings. The experiment was done as factorial with completely randomized design with two strains of bacteria (*Pseudomonas sp* and *Serratia marcescens*) under four salinity stress levels (0, 400, 800 and 1200 mg sodium chloride per kg of quartz sand) on pistachio seedlings (Qazvini) in greenhouse condition. Pistachio was grown on a mixture of sepiolite and quartz sand for 150 days and irrigated with either distilled water or nutrient solution without Mg. The results showed a great impact of bacteria on the release of Si, Mg and Fe from the sepiolite. So that, the presence of these strains reduced MgO amount of the mineral from 38.97% to 26.86% and this release, as the only source of Mg in the environment, was able to provide the required Mg of seedlings. In addition to releasing significant amounts of elements from this mineral, bacterial strains were able to change the mineral structure and convert part of it to palygorskite in the root environment of pistachio seedlings. It seems that the presence of these bacterial strains in symbiosis with plants will have a significant effect on the release of elements from minerals and its absorption by the plant and thus improve plant nutrition and change the mineral structure.

Keywords: *Silicate solubilizing bacteria, Palygorskite, X-ray diffraction, Biological weathering.*

FARMERS' VIEWPOINTS REGARDING TRANSPLANTING VEGETABLE SEEDLINGS: THE CASE OF SOUTHWEST IRAN

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Abstract

Diffusion of innovations and new technologies requires the supports of institutions and individuals in terms of their commitment to acceptance. Due to various obstacles, transplanting vegetable seedlings, introduced recently to farmers in Southwest Iran, cannot be expected to be associated with high acceptance and application rate. Understanding the factors which construct the attitudes of farmers toward this method of cultivation has a significant impact on accelerating the process of their adoption. In line with this, a study was conducted aimed to investigate the farmers' viewpoints regarding adoption of transplanting vegetable seedlings in Dezful County, Southwest Iran. A survey method was used to collect data from a population consisting of 557 farmers who adopted transplanting vegetable seedlings in their farms. The research sample included 147 adopter farmers as well as a corresponding number of non-adopter farmers. Data was collected using a questionnaire which validity and reliability was confirmed based on the opinion of a panel of experts accompanying a pilot study. Results revealed that the adopter farmers' viewpoints in terms of their awareness of disadvantages, awareness of advantages, level of facilities preparedness, perception of functional benefits, perception of common benefits, value attributed to be as an innovative farmer, and general attitude toward transplanting vegetable seedlings were slightly higher than in non-adopters. Adopter farmers' perception regarding functional benefits, common benefits, and their general attitude toward transplanting vegetable seedlings were significantly higher than in non-adopters. Interestingly, these factors mainly are pertinent to their views about environmental conservation and reduction of production cost.

Keywords: *Transplanting Vegetable Seedlings, Environmental Protection, Food Safety, Iran.*

FARMERS' SUBJECTIVE WELL-BEING UNDER DROUGHT CONDITION: A COMPARISON BETWEEN DIFFERENT CULTIVATION SYSTEMS

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Abstract

Water scarcity and drought are the biggest challenges which threaten the agricultural development at present and in the future, in arid and semi-arid regions. Undoubtedly, reduction of crop yields will negatively affect the economy, well-being and quality of life in rural communities. Farmers damaged by drought, depending on their cultivation system, differently react in facing with water scarcity. In this regard a survey study was done to compare the well-being of rain-fed and irrigatedfarmers under drought conditions. The population of interest consisted of farmers living in Kuhdasht County located in west of Iran. A sample of 379 farmers was chosen through cluster sampling method. Data was collected using a questionnaire which validity was confirmed by a group of agricultural experts and its reliability was approved by calculating Cronbach's alpha coefficient. Results showed that the average of available water amount after drought period, based on the farmers' opinions, was significantly decreased. In better words, drought made a dramatically decline in surface and groundwater table, causingsubstantial reduction in cultivated areas, both in rain-fed and irrigated. Therefore, decrease in cultivated areas as the most important coping strategies applied mainly by rain-fed farmers, causes them to lose their subjective well-being. Hence, the difference between well-being of irrigated farmers (185.55) and rain-fed farmers (174.04) was statistically significant. The results also revealed that subjective well-being of literate and well-educated farmers was significantly lower than regarding illiterate ones. Generally, drought affected farmers' well-being negatively, particularly rain-fed, young, smallholders, literate and well-educated farmers.

Keywords: *Drought management, Water Scarcity, well-being, Iran.*

EFFECTS OF GAMMA IRRADIATION ON ESSENTIAL OIL OF *SATUREJA HORTENSIS* L.

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Abstract

Summer savory is an annual, valuable medicinal and aromatic plant of the Lamiaceae family. The objective of this study was to determine the effects of gamma irradiation on essential oil in *Satureja hortensis* L. Dry seeds (12% moisture) of savory were irradiated with five doses of gamma-rays viz., 20 Gy, 40 Gy, 60 Gy, 80 Gy and 700 Gy using cobalt 60 source at a dose rate exposure of 121.58Gy/hr. A randomized complete block design (RCBD) was used, and data analyses were carried out accordingly. Three replications of 100-seeds each were sown for every treatment and control in each dose of gamma rays. Secondary metabolites are a diverse group of low molecular weight; they assist plants to interact with the environment both biotic and abiotic and to establish defense mechanisms. The type of stress and its magnitude are the major factors determining the effects on the production of secondary metabolites. Gamma irradiation application led to a significant increase in essential oil content of *S. hortensis.* The essential oil was shown to contain four dominant components, i.e. carvacrol, gamma-terpinene, alpha-terpinene, and thymol. The highest carvacrol and thymol content concentrations were determined in essential oil extracted from the highest dose (48.85 and 32.64 %, respectively).

Keywords: *Carvacrol, Essential oil, Gamma irradiation, Summer savory.*

CHEMICAL ANALYSES OF THE ESSENTIAL OILS AND ANTIOXIDANT ACTIVITY FROM *SATUREJA HORTENSIS* L. ACCESSIONS FROM EUROPE AND ASIA

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Abstract

Satureja hortensis L. is a medicinal plant from the Lamiaceae family and has antioxidant, antispasmodic, antimicrobial and antidiarrheal characteristics. Recently, the antimicrobial and antioxidant features of herbal medicine have been more considered in food and drug science and *S. hortensis* is a rich source of them. In this research antioxidant and phytochemical characteristics of *S. hortensis* accessions originated from Iran, Armenia, Germany, Greece, Georgia, Romania, Hungary, Tajikistan, Italy, Russia and Uzbekistan were evaluated. Rosmarinic acid, 2,2-diphenyl-1-picrylhydrazyl (DPPH), Ferric Reducing Antioxidant Power (FRAP) and essential oil compounds were analyzed. The maximum amount of rosmarinic acid (1.28 µM mg) and essential oil contents (0.73 %) were obtained by Sanandaj and Germany accessions, respectively. The Germany accession had the highest DPPH, FRAP carvacrol, ɣ-terpinene, α-pinene, camphene, octen, phellandrene and some other compounds. Among essential oil compounds, the highest correlation was shown between phellandrene and camphene (r= 0.97%). The highest negative correlations were between a-fenchyl acetate and camphene (r= −0.434), alloaromadendrene and α-tujene (r= 0.416), and between alloaromadendrene and octatriene (r= −0.417). Carvacrol had negative correlations with most of the constituents while Thymol had positive correlations with all of compounds except α Terpinolene, β-Fenchylalcohol and α Terpineol (r= -0.2, -0.18 and -0.16 respectively). Clustering from essential oil components assigned accessions into five clusters. The findings of this research can be used to sketching efficient breeding programs for this plant.

Keywords: *Correlation, Cluster, Essential oil, Rosmarinic acid.*

GRAPHIC ANALYSIS OF DROUGHT TOLERANCE IN DURUM WHEAT GENOTYPES USING STRESS SELECTION INDICES

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Abstract

The objective of this study was to apply the three-dimensional plots of stress selection indices to screen tolerant genotypes of durum wheat. Fourteen genotypes were grown under both drought stress and potential conditions using a randomized complete block design with four replicates. Eight drought tolerance indices were used as well as yield performance under potential (YP) and stress (YS) conditions for drawing three-dimensional plots. Genotypes G1, G4, G5, G6, and G13 were found the most favorable genotypes according to YP, YS and SSI, while genotypes G3 and G8 displayed the highest performance based on STI. Using modified STI indices, K_1STI and K_2STI did not alter pervious results and produced similar findings. The three-dimensional plots based on average statistics (MP, GMP and HM) as well as YP and YS identified G3 and G8 as the best genotypes, while according to TOL, genotypes G3 and G4 were selected as the most favorable genotypes. Although genotypes performed differently in potential (YP) and stress (YS) conditions, which justifies screening them for both conditions simultaneously, we could find some genotypes which responded good in both conditions like genotypes G3 and G4. Therefore, most of studied indices could discriminate drought tolerant genotypes with high yield using the three-dimensional plots.

Keywords: *the three-dimensional plots, graphic analysis, tolerance indices.*

THE EVALUATION OF SEVERAL MINERAL FERTILIZERS' TYPES ON MAIZE TRAITS

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Abstract

Managing of nutrient application is a major part of the production program while nano-fertilizers application may have good opportunity for achieving crop production goals. An experiment was performed to study the effect of adding some nano-size and biological fertilizers on maize under normal irrigation regime (up to ~50% field capacity). Fertilizer treatments included Control (Nf; no-fertilizer application), *nitrogen biofertilizer (Bio-N), phosphorus biofertilizer (Bio-P), nano-chelated boron (Nano-B), nano-chelated* zinc (*Nano*-Zn), complete nano-fertilizer (*Nano-C*) and conventional mineral NPK *(nitrogen, phosphorus and potassium) fertilizers. Results indicated that* Bio-P was the best treatment in terms of yield performance, ear length, biological yield, number of the kernels per row, length of ear leaf and straw yield traits, while Nano-Zn was the best treatment for increase in protein content and Nf was the best treatment for increase in oil content. The biplot, also, demonstrated that Bio-N was the best treatment in terms of leaf area, ear diameter and hundred grain weight, while Nano-B was the best treatment for plant height, harvest index, stem diameter, number of the row per ear and number of the kernels per ears traits. Nano-C and NPK were not outstanding for any of the traits.

Keywords: *yield performance, nano fertilizers, micronutrient, morphological traits.*

INVESTIGATION OF NANO AND BIO FERTILIZERS ON YIELD AND YIELD COMPONENTS OF MAIZE UNDER LIMITED IRRIGATION

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Abstract

Nanotechnology is an emerging science exploited in many areas such as applications. In order to investigate the environment-friendly fertilizers (nano-sized and biological types), which can limit the nonpoint source pollution from the source, a study was taken to study the effects of bulk-fertilizers (NPK, nitrogen bio-fertilizer, and phosphorus bio-fertilizer), nano-fertilizers (nano-boron, nano-zinc and nano-complete) and control treatment on maize traits. The first two principal components accounted for 72% of the variation of the treatment by trait interaction pattern. The nano-zinc fertilizer a following to nano-boron fertilizer was the best in most of the biological and seed yield performances. The vector-view biplot showed a strong positive correlation between chlorophyll and protein content, as well as between seed yield with number of the kernels per ears. Nano-complete fertilizer was the best treatment for chlorophyll content, protein percent and straw yield, while NPK was not better in most of the traits of maize. This study demonstrated that biplot of treatment by trait interaction could graphically indicate the correlations among traits and facilitate visual comparison of fertilizers. Finally, we found that the zinc and boron nano-fertilizers increased significantly the high values for most traits, thus such new modern environment-friendly fertilizers could be used for sustainable production of maize.

Keywords: *biplot, nano-boron, nano-zinc, treatment by trait pattern.*

EFFECT OF COLD PLASMA, SEED COAT SALICYLIC ACID NANO-FORMULATION ON SOME PHYSIOLOGICAL TRAITS OF *SALVIA LERIFFOLIA* BENTH. SEED

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Abstract

In order to investigate the simultaneous effect of seed coat removal (with and without hydroprime), cold plasma (surface power densities including 80 and 100 w for the time of 240 s) and salicylic acid formulation (in seven levels including control and 1, 1.5 and 2 mil.L^{-1} as nano and usual formulation) on some physiological traits of *S. leriffolia* Benth seed, a pot experiment was conducted in Shahrood University of Technology in 2019. Results showed that application of salicylic acid as nanoparticle or common formulation increased super oxide dismutase (SOD) and hydrogen peroxide (H_2O_2) compared with control significantly. The maximum amount of malon-dialdehyde (MDA) was obtained by using of 2 mil. L^{-1} nanoparticles of salicylic acid. Seedling dry weight increased by cold plasma treatment (100 w), while this treatment had no effect on the SOD enzyme. Seed coat removal significantly increased the amount of hydrogen peroxide (H_2O_2) compared with seeds with coat. Dry weight of seedling increased by removal of seed coat in hydro-prime and non-hydro-primed seeds. The most seedling dry weight was observed by application of 2 mil.L^{-1} nanoparticles of salicylic acid. Our results suggested that removal of seed coat and pre-treatment of seeds by cold plasma and salicylic acid especially in nano-formulation, could improve some physiological traits of *S. leriffolia* Benth seed through affecting antioxidant enzyme activities and osmotic-adjustment products.

Keyword: *Medicinal plants, Improve germination, Antioxidant enzyme, Seed pre-treatment.*

POMOLOGICAL PROPERTIES OF SOME IRANIAN PLUM (PRUNUS DOMESTICA) CULTIVARS

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Abstract

Plums have been known as one of the most diverse fruits in temperate regions, although their variation and diversity also cause differences in the physicochemical features of the fruit. Therefore, the aim of this study is to introduce and investigate the physicochemical and pomological traits of these cultivars. The present study was conducted to investigate the physicochemical properties of 7 Iranian plum. Plum cultivars with the usual names included: 'Ghatretala', 'Pivehzhan', 'Rotaby', 'Ghandy', 'Beygom', 'Torghabeh Sabz' and 'Bokhara'. Analysis of variance demonstrated that all cultivars had significant differences ($p \leq 0.01$) for all measurement parameters of chemical and physical features. The results also showed that in most of the chemical features studied, cultivars 'Beygom' and 'Torghabeh Sabz' were superior to other cultivars and had the highest amount of chemical compounds. The results also showed that there was a high amount of compounds such as antioxidants, flavonoids and vitamin C in the cultivars. Therefore, it can be said that some of the cultivars investigated in this study were rich in bioactive compounds and had high nutritive values.

Keywords: *Antioxidant Capacity, flavonoids, Vitamin C, Physical properties.*

THE FIRST RECORD OF ASCOCHYTA BLIGHT ON JASMINE PLANTS (ARABIAN JASMINE) IN MOSUL-IRAQ

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Abstract

During the winter of 2020 and 2021, blight symptoms appeared on Arabian jasmine (*Jasminum sambac*) leaves when temperatures fell below 0^0C for several days in home gardens in (Al Kafaat 2) the city of Mosul, and when temperatures rose to 18^0C during the day. The symptoms of infection appeared on the leaves in the form of irregular spots, and their diameter ranged from 2 – 50 mm. The area of the infection was green to brown, interspersed with many asexual fruiting bodies (Pycnidia) of the *Ascochyta*, and the spots widened and coalesced to the fall of the leaves . The spots spread on the surface of the leaves to cover large areas of the blade and gave symptoms of blight, then the leaves dried and fell off. Several papers were collected and transferred to the laboratory in order to isolate the causative agent. The fungi that appeared, *Ascochyta* were purified using the single spore method. The plants grown in the home garden were inoculated with the fungus, and the plants inoculated with the *Ascochyta* gave spots similar to the spots that appeared naturally on the plants.

Key words: *Jasmine plant, Iraq.*

EFFECTS OF DIFFERENT AUXIN (IBA) CONCENTRATIONS ON ROOTING OF COMMON LANTANA (LANTANA CAMARA) AND ABELIA (ABELIA X GRANDIFLORA) CUTTINGS.

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Abstract

Nurseries involved in the production of ornamental shrubs for use in public and private green areas propagate plants by cuttings. Enhancing and optimizing the rooting process is important for the quality of the plants and the success of the subsequent transplant. To this end, the study analyzed the morphology of adventitious roots developed from median stem cuttings of two ornamental shrubs, Lantana camara and Abelia grandiflora, treated with an auxin plant growth regulator. The study compared the application of four different IBA (Rhizopon, available commercially) concentrations (0, 0.5, 1.0, and 2%) to two cultivars of Lantana (cv 1 Coccinella and cv 2 Yellow) and two of Abelia (cv1 Rupestris and cv 2 Eduard Goucher). Median cuttings were taken from the mother plants and placed in honeycomb containers filled with a commercial rooting substrate. The experimental design was complete randomization, with three replicates for each treatment, for a total of 48 experimental units. Root morphology was analyzed using the WinRHIZO software and rooting percentages were determined. Results indicate that IBA treatment significantly influences root morphology 54 days after cutting. In Lantana, 2% IBA produced an increase in length (+ 36%), surface area (+ 45%), tips (+ 40%); in the forks, however, 1% IBA yielded a 39% increase compared to the untreated control. CV1 showed a more extended root system than CV2. In Abelia, 0.5% IBA yielded results comparable to the highest dose (2%); the CV2 root system was more developed than that of CV1.

Keywords: *Ornamental nursery, Vegetative propagation, Auxine, IBA.*

INFLUENCE OF AGRONOMIC TECHNIQUES ON QUANTITATIVE AND QUALITATIVE PRODUCTION OF ESSENTIAL OILS OF SOME OFFICINAL SPECIES

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Abstract

Aromatic plants, in addition to the primary metabolites, fundamental in the life cycle of the plant, produce high levels of secondary metabolites, biologically active compounds that can confer a range of properties such as aromas, fragrances, antioxidant and antimicrobial effects, as well as therapeutic and pharmacological properties. Conditions of stress and alteration of the balance within the plant organism stimulate the production of secondary metabolites, since these substances actively participate in the restoration of normal conditions and the survival of the plant. *Lamiaceae* are characterized by high adaptability and resistance in the most disadvantaged environments, having Mediterranean origin and able to withstand the most diverse climatic conditions; moreover, they are known for high content in active ingredients and essential oils to be used, in addition to the food sector, also for therapeutic uses and the preparation of cosmetics, drugs and pesticides. One of the main aspects distinguishing the quality of officinal species is the content and composition of essential oils, parameters influenced by numerous endogenous and exogenous factors. The aim of this review was to investigate the influence that some cultivation techniques, such as planting density, irrigation regime, fertilization, harvest time, had on the commercial yield, on the percentage content and on the composition of the essential oil extracted from *Origanum. vulgare* L., *Rosmarinus officinalis* L., *Salvia officinalis* L., *Thymus vulgaris* L., four species belonging to the Lamiaceae family widespread in the Mediterranean area.

Keywords: *Aromatic plants, essential oils, yield, agro techniques.*

CHASING DROUGHT STRESS IN LPA1-1 MAIZE MUTANT: EVALUATION OF THE ROOT SYSTEM ARCHITECTURE AND PHOTOSYNTHETIC PARAMETERS

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Abstract

Phytic acid (PA) represents the major storage form of phosphate (P) in the seeds. It is accumulated as phytate salts with different cations, reducing their bioavailability. Only ruminants can degrade PA due to the presence of phytases in the digestive tract, while monogastrics assimilate only 10% of phytate in feed and 90% is excreted, contributing to P pollution and water eutrophication. Hence, many low phytic acid (*lpa*) mutants have been isolated: in maize, *lpa1-1* is characterized by a 66% reduction in PA, followed by a proportional increase in inorganic P. Unfortunately, PA decrease is followed by negative pleiotropic effects on the seed and on plant performance. One of these agronomic defects observed on *lpa1-1* is a greater susceptibility to drought stress, which could be caused by an alteration in the Root System Architecture (RSA). With the aim to assess the effect of drought stress on the mutant, we have compared the RSA of *lpa1-1* to a wild phenotype in a two-replicates greenhouse experiment. In this work we present the results obtained. They clearly show that a variety of morphological changes have occurred in the aerial part of the mutant plant rather than in the root system. Drought stress in the mutant seems to be caused by a different photosynthetic efficiency and not by a shallower root system. Studying and overcoming the pleiotropic effects affecting *lpa* mutants would determine numerous potential benefits for the nutritional quality of food and feed and for the environmental P sustainability in agriculture.

Keywords: *low phytic acid mutants, maize, root system architecture, drought stress, P sustainability.*

OPUNTIA FICUS-INDICA (L.) MILLER AS A SUSTEINABLE SOURCE FOR NATURAL DYES PRODUCTION

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Abstract

The evolution of the circular economy model has led to an increasing interest in bio-products, made from biomasses or from industrial wastes. These products are manufactured using less energy and water, and producing fewer polluting emissions and waste. Several categories of bio-product have been gaining ground, such as natural dyes, which are a viable alternative to synthetic ones, as they are extremely healthier for humans and the environment. Within this context, red-purple prickly pear peels (*Opuntia ficus-indica* (L.) Miller) has been suggested as a precious source of betalains. In general, betalains are water-soluble nitrogen-containing pigments, which provide red-violet (betacyanins) and yellow (betaxanthins) colours to some fruits and vegetables. The aim of this work was to obtain a natural dye from the *Opuntia ficus-indica* (L.) Miller peel. Two different techniques were compared for the extraction of betalains: the conventional maceration extraction (ME) and a new one, the Naviglio extraction (NE), based on suction principle. The extracts have been quantified by UV/VIS spectroscopy and characterized by HPLC-MS. Results showed that using the same extraction conditions (solvent, pH, temperature, time), the extracts obtained with the NE were richer in pigments. Plant-based fibres (cotton) and animal-based fibres (wool) were used for the staining tests. Two etching methods were evaluated: rock alum (potassium alum sulphate), and lemon juice. The staining efficiency was assessed using the CIELAB colour system (CIE 1986). Results proved that *Opuntia ficus-indica* (L.) Miller extract had a good dyeing ability whether using mordants or not.

Keywords: *Opuntia ficus-indica (L.) Miller, natural dye, textile dye, betanins, Extractor Naviglio.*

WHY CONSUMERS PREFER GREEN FRIARIELLO PEPPER: CHANGES IN THE PROTEIN AND METABOLITE PROFILES ALONG THE RIPENING

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Abstract

Fruit ripening is a physiologically complex process altering texture, color, flavor, nutritional value, and aroma. However, some fruits are consumed at an early stage of ripening due to the very peculiar characteristics varying during ripening. An example is a particular ecotype of pepper, the Friariello pepper, among the most important representatives of Campania (Southern Italy) agro-alimentary culture. In this study, for the first time, the physiological variations during Friariello ripening (green, veraison, and fully ripe) were evaluated by hyphenated mass spectrometric techniques in a proteomic and metabolomic approach. We found that Lutein and Thaumatin were particularly abundant in the green Friariello. Friariello, at an early stage of ripening, is rich in volatile compounds like butanol, 1 3 5-cycloheptatriene, dimethylheptane, a-pinene, furan-2-penthyl, ethylhexanol, 3-carene, detected by gas chromatography-mass spectrometry (GC-MS) analysis, which give it the peculiar fresh and pleasant taste. The detected features of Friariello may justify its preferential consumption in the early ripening stage and outline new knowledge aimed at preserving specific agro-cultural heritage.

Keywords: *proteomics, metabolomics, fruit ripening, agro-biodiversity, Capsicum annuum L.*

DEVELOPMENT OF NEW VARIETIES OF CAMELINA SATIVA THROUGH BREEDING PROGRAMS BASED ON PURE LINE METHOD AND BULK METHOD

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Abstract

Camelina (*Camelina sativa* L. Crantz) is an herbaceous annual oilseed crop belonging to the Brassicaceae (Cruciferae) family originated from southeastern Europe and southwestern Asia. The interest in this crop has increased significantly in recent years, especially for the short life cycle, the high oil content (up to 40%), the high level of unsaturated fatty acids (30-40% alpha linolenic acid, 15-25% linoleic acid, 15% oleic acid and about 15% eicosenoic acid fraction) and low-input agronomical practices. The erect plants reach aheight between 30 and 90 cm. The leaves are lobed both in the rosette and along the single stem. The flowers are small, yellow, in terminal clusters without bracts. The pear-shaped siliques contain seeds 7 to 9 mm long, not susceptible to deiescence. Genetic studies of the C. sativa genome suggest a polyploid structure, possibly hexaploidy (2n = 40, genome size ~ 782 Mb). A limiting factor regarding the utilization of Camelina sativa is the presence of high level of glucosinolates in the seeds. Glucosinolates are sulfur-containing glucosides, mainly present in Brassicaceae, involved in plant defense. The aim of this work is to develop new spring varieties of *Camelina sativa* with high yields by two different breeding programs: "pure line method" and "bulk method". Breeding programs have been supported by MAS (Marker Assisted Selection) to easily select genetic materials, by bromatological analyzes to evaluate the chemical parameters of the seeds and by GBS (Genotyping by Sequencing) to characterize/compare the new putative developed varieties.

Keywords: *Camelina sativa, plant breeding, glucosinolates, MAS, GBS.*

GENETIC IMPROVEMENT OF CUCURBITA MAXIMA FORCAROTENOIDS CONTENT

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Abstract

MIND Foods Hub is an innovative agri-food research project funded by the "Research and Innovation Hub" call of the Lombardy Region. It has an unprecedented breadth and dimension and brings together research institutions of excellence and companies of international standing and rooted in the territory. One of the main objectives is the sustainable production and processing of plant products and derivatives with an excellent nutritional profile. In this work new varieties of pumpkin are being developed witha breeding program based on "pedigree method" with the aim to improvethe carotenoids content and to improve the sensory characteristics and consumer acceptability. Pumpkins and squashes (*Cucurbita* L. spp.) are plant crops widespread in the world. The genus Cucurbita is characterized by a large genetic variability. The three most important species are *Cucurbita moschata*, *Cucurbita maxima* and *Cucurbita pepo*. *Cucurbita maxima* is considered the most appreciated species not only in the most developed countries, but also in low-income countries where Cucurbit is often used in intercropping with other plants like maize and bean. It also represents an important resource of vitamin A. The vitamin A deficiency (VAD) is an issue that could be solved with an enough integration of carotenoids in the diet. Pumpkins and squashes are rich in carotenoids, especially in β-caroteneand in sugars, starch, vitamin C, vitamin E and fiber. In this work, the last progresses regarding the development of the most promising materials will be shown.

Keywords: *Cucurbita maxima, plant breeding, pedigree method, carotenoids.*

SALINITY TOLERANCE OF ITALIAN TRADITIONAL CEREAL VARIETIES

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Abstract

Future projections indicate that by 2050 the world population will reach 10 billion. Currently, about 10% suffer from hunger and 25% have nutritional deficiencies. Climate change will exacerbate and have a detrimental effect on food production. The salinization of agricultural landis the climate change and industrial agriculture main consequence.is This phenomenon negatively affects many physiological processes of plants including germination and biomass accumulation. The aim of this study is to evaluate the tolerance to the sale of traditional varieties and their possible use to ensure future food security. The study focused on 4 Italian traditional varieties (*T. aestivum* L. var. Verna, *T. durum* Desf. var. Senatore Cappelli, "Einkorn" *Triticum monococcum* L, "Emmer" *T. dicoccum* L.) and one modern crop (*T. durum* Desf var. Claudio). Germination tests were carried out at increasing NaCl concentrations (0, 50, 100, 150, 200, 250 and 300 mM). In order to obtain growth and productive data, in half of seedlings salt stress has been continued. The varieties showed very different salt tolerances. Both germination percentages and growth of Çlaudio and Senatore Cappelli were more negatively influenced by NaCl than other varieties. The high salt tolerance observed for Verna, Emmer and Einkorn suggested that reintroduction of traditional crop varieties could help to meet future climatic, economic, and social challenges by directing food production towards productive, stable, and resilient agroecosystems, while minimizing environmental impacts.

Key words: *Salinity, traditional Italian varieties.*

MORPHOLOGICAL AND PRODUCTIVE CHARACTERIZATION OF SEVEN ACCESSIONS OF *CAPPARIS SPINOSA* L. SUBSP. *RUPESTRIS* IN LINOSA ISLAND IN ITALY

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Abstract

The caper is widespread in the Mediterranean basin both spontaneously and in specialized cultivation, showing considerable genetic and phenotypic variations. Although this plant represents a good opportunity for growers in subtropical areas, it still needs innovation in agrotechnical techniques. The aim of the study was to evaluate the morphological and productive behavior of seven accessions of *C. spinosa* L. subsp. *rupestris*, identified on the island of Linosa, in the two-year period 2007-2008. The experimental protocol involved a randomized block design. Not only the main morphological and production parameters were determined but also the phenological phases. In order to broaden the qualitative parameters of the flower buds, in addition to the evaluation of the diameter, the consistency was evaluated using a penetrometer. The results obtained showed variability between accessions and higher levels of production in the second year. Although for most of the parameters examined the best results were provided by the SCP2 access, it is also worth noting that the results for the SCP1 and SCP5 biotypes were also satisfactory. Our results have allowed us to identify accessions of interest for the introduction of new caper fields. Further research is needed to characterize caper biotypes in terms of the chemical composition of flower buds and fruit.

Keywords: *caper plant, island of Linosa, morphological and productive characteristics, growing.*

PHYTOCHEMICAL CHARACTERIZATION OF STRAWBERRY TREE (*ARBUTUS UNEDO* L.) LEAVES AND FRUIT EXTRACTS AT VARIOUS RIPENESS

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Abstract

In this work, the *Arbutus unedo* L. leaves and fruitshave been characterized, the second one sat different levels of ripeness. The strawberry tree leaves and fruits, ripen through four different colours, have been extracted through two different techniques, maceration and sonic waves, comparing them in the same conditions (solvent, pH, temperature). The results showed that the extracts obtained by different techniques had different characteristics in terms of antioxidant activity, scavenging activity and bioactive components. The use of the extraction technique of sonic waves has proved more performing than conventional extraction with maceration. The presence of antioxidant and scavenging compounds was determined using the Folin-Ciocâlteu reagent and the DPPH method, respectively. The data obtained showed different and interesting results depending on the ripeness of the fruits. Extracts in the ethanol-water mixture showed a more positive effect than the use of the single aqueous solvent in terms of the total phenolic compounds content. In addition, the bioactive compounds and amino acids contents of *Arbutus unedo* L. extracts were characterized by the use of liquid chromatography coupled with mass spectrometry. Anthocyanins, carotenoids, catechins, phenolic acids and polyphenols in general have been found: some molecules have been characterized for the first time in extracts from *A. unedo*. Finally, the results suggest that fruits of *A. unedo* may be of great interest as a natural source of many bioactive compounds for food and nutraceutical applications.

Keywords: *Arbutus unedo L., Strawberry tree, Antioxidant activity, Radical scavenging activities, Bioactive compounds.*

THE SOCIAAALP PROJECT: REINTRODUCTION OF RYE AND WHEAT IN ANTRONA VALLEY BY VARIETAL COMPARISON

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Abstract

In the frame of the SOCIAAALP (Reti Sociali per Agroambienti Alpini) project granted by CARIPLO foundation we reintroduced rye and wheat in Antrona Valley (Piemonte) with the aim to resume the historic rye bread production chain that had been abandoned several years ago. Rye bread is a type of bread made with different proportions of rye/wheat flour. Rye bread was considered a staple through the middle ages and in mountain areas the use of rye bread was a tradition until the beginning of the second half of the last century when it was abandoned following the depopulation of the mountain areas. In recent years, a renewed interest in this product has been growing due to the nutritional properties of rye flour. In this project, we selected in randomized block designs the best rye and wheat varieties for the Antrona valley terraced environment. We also carried out nutritional analysis on flour collected for each variety. Adaptation to climate change is a very difficult breeding goal because of its complexity, its location specificity and unpredictability. However, one possible solution in small scale is based on dynamic use of agrobiodiversity in agriculture through the cultivation of evolutionary populations. In fact, in this project we used pure line, mixed and populations. In this work we will show the results obtained in last two years of trials.

Keywords: *Rye, Wheat, Agrobiodiversity, Terraced environment.*

CHEMICAL COMPOSITION OF GRAIN (SORGHUM BICOLOR L. MOENCH) UNDER EFFECT ON PLANT DENSITY AND NITROGEN APLICATION

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Abstract

Effects of different nitrogen levels and plant inter-row spacing on chemical grain composition of two sorghum varieties were studied. The experiment was carried out on the farm of the glasshouses project of Misurata city-Libya. The experimental site was 32016'10.10" N 150 02'49.66" E. Seeds of Sorghum bicolor (L) cv. Azra3 and Azra7. using (RCBD) Split-split arrangement were chosen to allocate the treatments i.e.: two inter-row plants spacing and five levels of nitrogen which were randomly assigned to the experimental units. The results of the analysis of variance of the effect treatments tested on the chemical characters of the two cultivars, showed no significant difference. The protein content in grain of sorghum showed the general average of protein ratio 9.62 - 9.257% for the two cultivars, but the deferent was not significant. The crude fiber content in grain of sorghum showed Cultivar Azra3 produced the highest of grain crude fiber under 200 kg N ha-1 (2.52%) and cultivar Azra7 was (1.88%). The average of crude fat in grain was 3.6 % and 3.7% for cultivars Azra3 and Azra7 respectively. The average percentage of crude ash in grain was 2.11%. The analysis of variance of Carbohydrates content shows that there are no significant differences in effect of fertilization and plant spacing.

Keywords: *Sorghum, Nitrogen, Plant density, Chemical Composition.*

EFFECT OF REDUCED TILLAGE, STRAW AND GREEN MANURE INCORPORATION ON WINTER WHEAT GRAIN QUALITY

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Abstract

Agriculture is developing and growing in Lithuania due to suitable climatic conditions, but prevailing greater differences in soil diversity, uneven relief, and various distribution of precipitation. Research was carried out in 2020 in a stationary long-term field experiment, which was set up in 1999 at the Experimental Station of Vytautas Magnus University (54º52′50″ N latitude and 23º49′41″ E). The object of the research was winter wheat (*Triticum aestivum* L.) crop with different tillage systems. The aim of this experiment was to investigate the effects of various-intensity long-term tillage, green manure and straw incorporation on winter wheat grain quality. The long-term experiment was laid out in a split-plot design with 4 replications and a total of 48 plots. A short crop rotation was introduced: winter wheat → spring barley → spring oilseed rape. Treatments were arranged using a split-plot design. In a two-factor field experiment, straw was removed from one part of the experimental field, and in the other part of the field, the entire straw yield was chopped and spread at harvest (factor A). There were 6 different tillage systems as a subplot (factor B). Long-term application of continuous reduced tillage increased winter wheat crop density, protein content in grain, sedimentation, and amount of wet gluten. Long-term application of less intensive soil tillage in combination with the use of plant residues and green manure allows maintaining the agroecosystems stability of productivity.

Key words: *reduced and no-tillage, cover crops, winter wheat, productivity.*

LONG-TERM SOIL STABILITY REFLECTED BY COMPLEX MEASURES

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Abstract

Improved management practices must integrate unique differences in climate and site-specific soil properties, including the use of crop residue management to improve carbon sequestration as soil stability measure. Therefore, a study was initiated to evaluate the effects of long-term use of plant residues and cover crop for green manure in combination with reduced tillage and no-tillage with direct drilling on organic carbon pools, crop yield and agroecosystem sustainability. Soil organic matter accumulation and their effect have been estimated in a long-term field experiment that was conducted as *Endocalcaric Stagnosol* (Aric, Drainic, Ruptic, Amphisiltic) at 54º52′50″ N latitude and 23º49′41″ E longitude since 1999 (established at Vytautas Magnus University Experimental Station). The following crop rotation sequence was employed: spring rape, winter wheat, spring barley. In one part of the experiment, the straw was removed (R), and in the other part the straw was chopped and spread (S). All tillage systems were studied in both parts of the experiment, i.e. with straw removed and straw chopped and spread. Factor A- straw retention: without straw (control) (W), with straw retention (S). Factor B - 6 different tillage systems. After 20 years, soil tillage systems with permanent crop rotation and cover crop treatment influenced the accumulation of SOM via soil organic carbon (SOC) stabilization. Meanwhile single seedbed discing, cover crops followed seedbed discing, and no-tillage increased accumulation of SOC in the ploughed (0-20 cm) layer by 1.5 times. Regular straw retention, single seedbed discingwith or without green manure and no-tillage with direct drilling significantly increase organic carbon stocks in soil.

Key words: *long-term soil tillage systems, cropping, soil organic carbon.*

EFFECT OF LIGHT PHOTOPERIOD ON GROWTH AND PHOTOSYNTHETIC INDICES OF KALE SEEDLINGS

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Abstract

Fresh leafy greens are the most consumed vegetables worldwide because of their known potential to enrich human health with minerals and compound shaving antioxidant properties. Recently more greens are produced in controlled environment agriculture (CEA) systems, where the plants are grown under artificial lighting such as light-emitting diodes (LEDs). The properly selected LED lighting parameters, including photoperiod, can ensure healthy plant growth and productivity. This study aimed to evaluate the influence of LED lighting photoperiod on the development and photosynthetic indices of kale seedlings (*Brassica oleracea* 'Red Russian'). Plants were grown for 17 days in a closed controlled climate chamber: day/night temperature 21/18°C, relative humidity 55±5%, white LED (5700 K, Heliospectra, Sweden) light at 12, 18 and 24 h photoperiod, and total photon flux density (PPFD) of 200 μmol m^{-2} s^{-1}. The results showed that seedling hypocotyls were shorter due to the prolonged 18 and 24 h photoperiod, but plants grew taller than under the 12 h photoperiod. Seedlings grew under 24 h photoperiod formed longer and wider first true leaves and thicker hypocotyls and had higher fresh and dry weight than those under 12 h or 18 h illumination. Although the light period did not affect the photosynthetic rate and stomatal conductivity, the intercellular CO_2 concentration and transpiration intensity of kale decreased due to the prolonged illumination time. The lower levels of chlorophylls and carotenoids were found in seedlings grown at 18 and 24 h for lighting compared to those exposed at 12 h. In summary, the photoperiod is an important factor determining the vital processes in the plant, so it is necessary to select the duration of lighting to upgrade the growth rates without disturbing the function of the photosynthetic system of kale seedlings.

Keywords: *artificial lighting, controlled environment agriculture, leafy greens, light-emitting diodes.*

BIOFORTIFICATION OF MUSTARD MICROGREENS WITH IRON THROUGH LIGHTING AND NUTRITION STRATEGIES

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Abstract

Iron (Fe) is an essential micronutrient for plants as it plays a crucial role in metabolic processes such as DNA synthesis, respiration and photosynthesis. For humans, Fe is important for making critical proteins haemoglobin and myoglobin, as well as some hormones. Many people suffer from anaemia caused by Fe deficiency, so the consumption of Fe-rich vegetables is recommended. In this study, mustard microgreens (*Brassica juncea* cv. 'Red Lace') were grown indoors (T 21/17°C; RH 55%) for 10 days under red 660 nm and blue 447 nm light-emitting diodes (LEDs) at 9:1 and 1:3 ratios (PPFD 220 μmol m^{-2} s^{-1}) and in nutrient solution containing 2, 5, and 15 ppm of Fe. The increasing concentration of Fe consistently increased its content in mustard resulting in the highest content under 15 ppm regardless of the radiation treatment. The highest Fe translocation factor was calculated from leaves and roots of mustard treated with 1:3×15 ppm. Contrary, such lighting and nutrition strategy significantly decreased Fe bioaccumulation factor in microgreens compared to other treatments. Both – lighting spectrum and Fe content in solution- affected growth indices of mustard. The highest fresh and dry weights were in plants under 9:1×2 ppm. However, the largest leaves and longest hypocotyls were of mustard under 9:1×5 ppm Fe treatment. To sum up, the lighting and nutrition strategies can be used as a tool to increase the content of Fe in broccoli microgreens, but the uptake of Fe and growth indices depends on the compositions of radiation spectrum and nutrient solution.

Keywords: *bioaccumulation, growth parameters, leafy greens, mineral nutrients, translocation factor.*

Acknowledgement: This project has received funding from the Research Council of Lithuania (LMTLT), agreement No. S-MIP-19-2.

THE EFFECTIVENESS OF PHYSIOLOGICAL METHODS FOR OPTIMIZING WORK ON THE ARRANGEMENT AND RESTORATION OF OAK FORESTS

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Abstract

In the context of global warming, the need to restore and expand forest areas is becoming an increasingly urgent task. In Moldova, the most suitable afforestation is the oak species *Quercus robur* L., *Quercus petrea* Liebl. and *Quercus pubescens* Willd. To optimize the selection of oak species for afforestation in specific areas, we have determined the resistance of these species to high temperatures. Additional problems appeared due to the slow growth and low viability of seedlings in the first three years after sowing acorns. Having carried out many studies under controlled conditions, we have developed methods that allow us to obtain some plants, which in terms of viability and habitus already in the first year after germination exceeded the plants of the control variant at the age of two to three years. This conclusion is supported by the values of the parameters of annual growth, the number of leaves per seedling, leaf size, and their photosynthetic activity. Another critical factor is that the experimental plants more fully utilize the reserve substances of the cotyledons, which leads to accelerated growth and plant resistance to stress factors. Thanks to these features, the selection of valuable genotypes can already be at the planting stage. Thus the risks of seedlings suppression during the first years after planting and the costs for afforestation are reduced.

Keywords: *oak, physiological methods, afforestation.*

VARIABLE COMPONENTS DETERMINING THE PRIMARY RESISTANCE TO EXTREME TEMPERATURES OF THE WHEAT SEEDS REPRODUCED IN THE DIFFERENT CLIMATIC ZONE

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Abstract

Specific results of our research have shown that the primary resistance of wheat genotypes varies depending on the conditions of seed reproduction. In laboratory conditions, based on the evaluation of the seeds' germination capacity after their exposure to shock with high or sub-zero temperatures, we determined the resistance of different wheat genotypes reproduced in Moldova and Ukraine. The wheat varieties can be differentiated in the accelerated mode after their primary resistance to extreme temperatures (excluding the influence of the adaptation processes carried out during plant ontogenesis) by exposing them to heat shock or shock with negative temperatures the well-prepared for germination seeds. The resistance of different wheat genotypes seeds to extreme temperatures can vary, being influenced by the environmental conditions of their reproduction. Only a tiny part of genotypes demonstrated at the same time the high resistance to high and sub-zero temperature. As a rule, genotypes with high resistance to negative temperatures have a low level of resistance to high temperatures. In most cases, the primary resistance to negative temperatures of seeds reproduced in Moldova was lower than those produced in Ukraine. Overall, the obtained data support the view that the resistance of seeds of different wheat genotypes to extreme temperatures reflects the interaction between the primary resistance of the genotype and the influence of epigenetic inheritance factors on the seed resistance.

Keywords: Triticum aestivum *L., seeds, heat and frost tolerance.*

SAFFLOWER (*CARTHAMUS TINCTORIUS* L.) ADAPTABILITY UNDER CHANGING CLIMATE OF PAKISTAN AS A RESILIENT QUALITY OILSEED CROP

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Abstract

Safflower (*Carthamus tinctorius* L.), a xerophyte, withstands deleterious impact of changing climate was chosen for testing under local conditions of Pakistan. Pakistan imports nearly 84% of its total edible oil demands in addition to high fossil fuel imports. Safflower growing is not only meant for oil but is a multi-purpose rabi crop used as forages, medicinal value and for dye extraction from its flower petals. Exotic safflower seeds (100 accessions) were sown at the department of Agronomy, University of Agriculture Faisalabad- Pakistan to assess their response to semi-arid conditions aiming to select high seed yielders and better oil quality and quantity having accessions for their further adaptability under Faisalabad conditions of Pakistan. Selection also targeted spiny and nonspiny nature of safflower for ease in general commercial cultivation. Promising accessions were scrutinized for achene yield and oil quality. Results exposed that accessions PI 193765, 181866, 173885, 193473, 193474, 250525, 239353, 250597, 250006, 250198, 220250, 209291, 210460, 235659, 199829, 199873 and 237551 were significantly higher seed yielders whereas, higher oil contents were recorded in PI 250530, 237540, 250196, 250203, 250198, 209291, 199829, 181866, 239706, 220250, 199875 and 199898. Accessions PI. 181866, 193473, 193474, 250525, 250597, 250198, 220250, 209291, 235659, 199829 and 199873 were spiny whereas, PI 250006, 210460 and 237551 were non-spiny in nature. Better performer safflower accessions will further be tested for general cultivation to benefit the farmers as well as increase quality edible oil yields for future needs of the country.

Key words: *safflower, adaptability, selection, oil quality*.

IN VITRO CHARACTERIZATION OF FIXED OIL CONTENTS FROM CALLUS CULTURES OF JOJOBA (*SIMMONDSIA CHINENSIS* L.)

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Abstract

Objective of the present study was to investigate and determine fixed oil (lipids) contents from *in vitro* induced calluses of leaf, cotyledon and intermodal explants of jojoba (*Simmondsia chinensis* L.). The leaf and internodal explants were from micropropagated *in vitro* plants whereas mature seeds were used for the acquisition of cotyledons. Sterilized explants were cultured on different concentrations (1, 2, 4, 6, 8 or 10 µM) of either 2, 4-Dichlorophenoxyacetic acid (2, 4-D) or α-Naphthaleneacetic acid (NAA) alone or in combination (1+1, 2+1, 4+1, 6+2, 8+2 or 10+2 µM) with 6-Benzylaminopurine (BAP) or Kinetin (Kin) for callus induction. Highly proliferating callus lines (CLs) growing on 8 µM 2, 4 - D (CL-1), 10 µM 2, 4-D (CL-2) and 2, 4-D (10 µM) + 2 µM BAP (CL-3) were selected for the determination of fixed oil contents by distillation method. Highest rate of callus induction (100%) as well as 6.87 gm fresh weight was obtained from leaf explant on CL-3 after 99 days of culture. Amount of fixed oil content (290mg/6gm FW), acid value (0.320), free fatty acid (0.160) and saponification number (91) were highest from calluses of cotyledons on CL-1 as compared to other callus lines CL-2 or CL-3. The present investigation demonstrated an efficient method for determination of the fixed oil contents and related biochemical parameters from calluses of jojoba.

Keywords: *Callus, Fixed oil, Free fatty acid, Jojoba, Liquid wax.*

RESPONSE OF FINE RICE (*ORYZA SATIVA* L.) TO SOIL AND FOLIAR ZINC APPLICATION TO COMBAT ZINC MALNUTRITION

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Abstract

The Zinc insufficiency is a worldwide dietary limitation for crop production in many kinds of soils particularly basic and calcareous soils. Field experiments were designed to contemplate the effect of Zinc levels and application techniques on development and efficiency of rice during 2016. Analysis included nine treatments. Fine rice variety (aromatic) Super Basmati was utilized for study. Surprising impacts were seen on height of the rice plant, number of fertile tillers, grains per panicle, 1000-kernel weight, harvest index and grain yield. Highest plants 111.84 cm were recorded in treatment T6 (Zinc as soil application @ 25 kg/ha + Zinc as foliar application @ 0.5%).Maximum productive tillers per m^2 were seen with Zinc as soil application @ 25 kg/ha + Zinc as foliar application @ 0.5% and least productive tillers per m^2 (317.33 cm) were recorded under control treatment. Zinc application strategies particularly affected grain yield. Most noteworthy grain yield (5.79 t ha-1) was noted in treatment T6 (Zinc as soil application @ 25 kg/ha + Zinc as foliar application @ 0.5%) and least grain yield (3.03 t ha-1) was noted in control treatment (no application). These outcomes have significant ramifications for directing the objective use of Zinc nutrient strategies and working on the usefulness of zinc fertilizer to combat zinc malnutrition in Pakistan.

Keywords: *Zinc deficiency, Zinc application method, Doses, Aromatic, Fine rice.*

EFFECT OF APPLICATION OF POTASSIUM, ZINC AND BOR ON AS POTENTIAL MODULATORS OF HEAT STRESS IN BT COTTON (*GOSSYPIUM HIRSUTUM* L.)

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Abstract

Modulatory effect of potassium (K), Zinc (Zn) and Boron (B) were conducted for inducing thermotolerance in cotton at three reproductive stages under glasshouse and field conditions. The plants were subjected to varying temperatures (32/20°C ± 2, 38/24°C ± 2 and 45/30°C ± 2) under glasshouse. Furthermore, different thermal regimes were attained by ensuring sowing dates under field conditions. Plants under high (45/30°C ± 2) and medium (38/24°C ± 2) temperature regimes showed 70% and 31% higher relative cell injury (RCI), respectively, than control plants under optimal condition (32/2 °C ± 2). Yield was reduced under both growing conditions. Fiber quality traits were decreased by 42% and 19% at 45/30°C and 38/24°C, respectively compared to controlled plants. Plant nutrients such as K, Zn and B increased total soluble proteins and decreased H_2O_2 contents, where Zn had a prominent effect. A reduction in relative cell injury by 37% and 24% due to K and Zn was observed under supra and sub optimal conditions of glass house compared to water treated leaves of the respective thermal regimes. Furthermore, foliar application of K and Zn improved in total number of bolls per plant by 19% and 15% under high and medium temperature regimes in controlled environment. Folair spray of K, Zn and B could be applied in cotton before or during the heat stress which may improve the thermotolerance. The results suggest that Zn, K and B improve membrane stability and trigger biochemical transformations from oxidative stress under medium and high temperature stress.

Key words: *Cell injury, Gossypium hirsutum L., high temperature stress, macro and micro nutrients, yield and quality.*

IDENTIFICATION AND CHARACTERIZATION OF DOF TRANSCRIPTION FACTOR GENE FAMILY IN CASHEW (ANACARDIUM OCCIDENTALE)

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Abstract

The DNA binding with one finger (*Dof*) proteins are members of the plant-specific transcription factors (PSTFs) gene family, which are involved in several biological processes such as fruit ripening and organogenesis. In the present study we identified 67 Dof family genes in cashew genome. A complete overview of *Dof* genes in cashew is presented, including the gene structures, chromosome locations, phylogeny, subcellular localization cis regulatory analysis, protein motifs and evolution pattern. Cashew *Dof* proteins were classified into 11 subgroups, which were named as A, B1, B2, C1, C2, D, E1, E2, F1, F2 and F3. As compared to tandem duplication, segmental duplication was found to be more common, which was the main explanation for the large *Dof* gene family in cashew. The existence of elements specifically sensitive to light, circadian, ethylene, auxin, seed, and meristem was revealed by cis-regulatory elements (CREs) analysis. The evolutionary relationship between *Dof* genes in cashew, lettuce, and Arabidopsis is determined through a comparative study. The extensive genome evaluation of the *Dof* gene family in cashew presents a reference for cloning and functional analysis of the members of this gene family.

Key words: *cashew, DNA, Dof genes.*

INNOVATIVE TRENDS IN VEGETABLE NURSERY PRODUCTION

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Abstract

Healthy seedlings are the first and essential requirement for achieving highest yield potential of any vegetable crop. A major portion of the area under vegetable cultivation in Pakistan is now sown with hybrid seeds having good yield potential, which are costly and some time these seeds show poor seed germination and seedling establishment when raised through traditional nursery raising techniques. In view of the high cost of seeds, MNS-University of Agriculture Multan started raising of vegetables seedlings in plug trays to achieve the above requirement and successfully raised nursery of Okra, pakchoi, tomato, chili, pepper, brinjal, Cucurbits including gourds, pumpkin, vegetable Luffa, melons etc. This technology is fast emerging as agro enterprise in Pakistan for its obvious advantage to both the vegetable nursery grower and the farmer. Soil-less growing media consisting of Peat moss, Perlite and Vermiculite is used in multiplot seedlings trays and one seed is manually placed in each cell of the seedling tray and covered with media. The beginning of vegetable transplants through multiplot seedling tray have allowed growers of many specialty crops the ability to greatly reduce seed costs, increase stand uniformity, and in many cases increase yields and quality of the products produced. In the future, many more crops may be grown as seedling transplants, especially those of high economic value and potentially high seed cost.

Key words: *Peat moss, seedling, multiplot trays, vermiculite.*

UTILIZATION OF AN AGRO-INDUSTRIAL BY-PRODUCT FOR MICROALGAL BIOMASS PRODUCTION

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Abstract

Due to their numerous properties, unicellular algae have been applied in a variety of areas, e.g. food, chemical, cosmetic, and pharmaceutical industries as well as medicine and organic agriculture. One of the key steps in microalgal biomass production for industrial purposes is the choice of the culture medium that will ensure high cell biomass productivity and high content of particular compounds in the cells. Nowadays, researchers have highlighted the role of cost-effective and eco-friendly agro-industrial by-products used as supplements in algal cultivation. The aim of the study was to: (1) determine the potential of beet molasses as an alternative culture medium component, (2) examine the ability of green algae belonging to the Chlorophyta to utilize beet molasses, and (3) identify the basic metabolic pathways in *Tetradesmus obliquus* and *Parachlorella kessleri* cells induced by beet molasses addition. To assess the impact of molasses addition to the medium growth, curves for *T. obliquus* and *P. kessleri* were plotted and described with basic growth parameters. The effect on the biochemical composition was assessed by analysis of lipid content with a modified Bligh-Dyer method, determination of fatty acid profiles with GC/MS, and analysis of the carbohydrate and nitrogen/protein content with the Kjeldahl method. The use of beet molasses stimulated the production of *T. obliquus* and *P. kessleri* biomass. Application of beet molasses influenced growth and modified the biochemical composition of selected green algal species. The results showed enhancement of protein synthesis in the cells of both *P. kessleri* and *T. obliquus* especially in the mixotrophic growth. The fatty acid profile of both green algal species was dominated by acids with chain length C16 to C18, but the proportions of the fatty acids varied *depending on the* growth *conditions.*

Key words: *Molasses, Chlorophyta, biomass, Parachlorella kessleri, Tetradesmus obliquus.*

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INFLUENCE OF CITRATE NANOPARTICLES ON PHOTOCHEMICAL ACTIVITY, RESISTANCE TO PATHOGENS AND PRODUCTIVITY OF WHEAT

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Abstract

In field experiments, increase quantum efficiency of PSII (Fv/Fp), Rfd-values (chlorophyll fluorescence vitality indices) and content of photosynthetic pigments in wheat leaves after pretreatment of wheat seeds with solutions of citrate nanoparticles has been shown. The green weight of plants infected with bacteriosis and phytoplasmas after pretreatment with solutions of citrate nanoparticles, was increased, than without pre-treatment, in order: GeNPs>I-Se>SeNPs>VNPs as it has been shown. The Fv/Fp-values in leaves infected with phytoplasmas of plants after pretreatment VNPs or I-Se solutions were more, than without pretreatment. The Fv/Fp-value in leafs infected with bacteriosis after pretreatment of GeNPs compared to infected plants without pretreatment was increased has been shown. The Rfd-value in leaves infected with bacteriosis after pretreatment of GeNPs or I-Se compared to infected plants without pr-treatment was more has been shown. This value at infected plants with phytoplasmas after pretreatment of GeNPs or VNPs, compared to infected plants without pretreatment, was increased. In greenhouse experiments, Fv/Fp-values of plants leaves infected of phytoplasmas, bacteriosis and wheat streak mosaic virus (WSMV) after pre-treatment of solutions of citrate nanoparticles compared to infected plants without pretreatment has been increased. The pretreatment with nanoparticles GeNPs caused grain production by 15.6% increased has been shown. The weight grains/10 in plants on variant at infected with bacteriosis after pretreatment with Ge nanoparticles (with consortium of soil microorganism) were more, than without pretreatment has been shown. The weight grains/10 in plants on variant at infected with phytoplasmas after pre-treatment of plants of nanoparticles solution compared to infected plants without pre-treatment increased in order: GeNPs>I-Se>VNPs>SeNPs.

Keywords: *Wheat, bacteriosis, phytoplasmas, WSMV, nanoparticles.*

THE INFLUENCE OF POTASSIUM FERTILIZATION AND IRRIGATION ON THE VITAMIN AND AMINO ACID CONTENT OF TUBERS OF JERUSALEM ARTICHOKE (*HELIANTHUS TUBEROSUS* L.)

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Abstract

The objective of this study was to evaluate the effects of soil potassium (K) fertilization (150, 250 and 350 kg K_2O ha^{-1}) and irrigation on yield and tuber quality (fresh and dry matter yield of aerial biomass and tubers, concentrations of ά-tocopherol, β-carotene, essential amino acids and endogenous amino acids) in three cultivars (*Topstar, Violette de Rennes* and *Waldspindel*) of Jerusalem artichoke (*Helianthus tuberosus* L.). A field experiment was conducted in the Agricultural Experiment Station in Tomaszkowo (53º42'N, 20º26'E, NE Poland). The content of ά-tocopherol and β-carotene ranged from 1.60 to 2.65 and from 0.75 to 1.00 mg kg^{-1} DM, respectively, in the analyzed cultivars of Jerusalem artichoke grown in NE Poland. High fertilizer rates (250 and 350 kg K_2O ha^{-1}) increased the concentrations of ά-tocopherol in tubers by 47% and 66% on average, respectively. The stimulatory effect of high fertilizer rates on ά-tocopherol content (2.5-fold increase) was observed only in response to irrigation. Irrigation increased ά-tocopherol content (by 40%), but decreased the concentrations of β-carotene (by 25%) and the majority of essential and endogenous amino acids (alanine, glycine, histidine, isoleucine, leucine, lysine, phenylalanine, serine, threonine and valine). Jerusalem artichoke tubers were characterized by very high biological value of dietary protein (Essential Amino-Acid Index, 66–78).

Keywords: *Jerusalem artichoke, fertilization, irrigation, ά-tocopherol,β-carotene, amino acids.*

Notes/Comments: The results of our study were published in an article entitled: "*Jerusalem Artichoke: Quality Response to Potassium Fertilization and Irrigation in Poland*",Bogucka B., Jankowski K., Agronomy-Basel 2020,10, 1518. DOI 10.3390/agronomy10101518

ESTIMATION OF YIELD LOSSES AT HARVEST FOR AN EARLY SOYBEAN CULTIVAR BY MEANS OF A MATHEMATICAL MODEL

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Abstract

A mathematical model for estimating losses during harvest of soybean (*Glycine max* (L.) Merr.) cultivation is proposed. The model takes into account position of the lowest pods that are susceptible for being damaged and lost in the process of cutting at harvest. The losses are calculated for varying cutting height applied during harvest and the sowing density. The position of fruiting nodes and productivity of pods depending on sowing density for the early soybean variety has been experimentally determined. Availability of water during vegetation period appeared to be important factor deciding about the position of pods on stem and therefore strongly influenced the weight losses due to the cutting process. According to the model estimations, the lowest losses were obtained for the years with the sufficient precipitation during vegetation period and in essence they never exceeded the value of 15 g m^{-2} even for the highest level of cutting (15 cm) applied during harvest. For all sowing densities applied in the research (20–140 seeds m^{-2}), the increase of cutting height from 5 up to 10 cm caused increase of seed yield losses typically about two- and threefold. However, the losses increased even seven- and eight-fold at the cutting height of 15 cm, especially for the very high sowing densities. The highest percentage seed yield losses (11%) were indicated to appear at the lowest sowing density (20 seeds m^{-2}). In the case of favourable distribution of rainfall, high sowing density (80–140 seeds m^{-2}) is recommended because it ensures high yield of soybean. In general, from an economic point of view, sowing density of 80 seeds m^{-2} can be recommended as optimal one because it gives relatively high seed yield at the lowest percentage losses as compared to higher densities requiring greater costs, but providing similar yield.

Keywords: *Harvest losses, Fruiting nodes, Seed yield, Seeds density.*

VISCOELASTIC PROPERTIES OF APPLES UNDER VARIOUS MECHANICAL LOADING CONDITIONS

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Abstract

Stress relaxation experiment is commonly used for the identification of mechanical properties of fruit and vegetables. Viscoelastic parameters are closely correlated with chemical composition, e.g. soluble solids content or acidity as well as texture features, e.g. hardness, springiness or chewiness. The aim of this study was to determine the apple flesh force response in the wide range of deformation velocities (quasi static and impact mechanical loading conditions). During the research the cylindrical samples of "Beni Shogun" apples cultivar in the range of deformation velocities from 0.0002 to 1ms^{-1} were studied. The five-parameter generalized Maxwell model was used to describe the experimental stress relaxation curves. The experiments were carried out at different temperatures of apples: 2^{o}C, 10^{o}C and 20^{o}C typically encountered during handling operations. The relaxation times of the generalized Maxwell model decreased with the increase of deformation velocity. The relaxation times were related to the processes of gas and liquid flows in the intercellular spaces. The rapid decrease of both relaxation times was stated between deformation velocity of 0.0002 and 0.002 m^{-1}. It testifies to the existence of critical deformation velocity associated with the weakness of the apple structure at the velocity mentioned above. The fifth model parameter (equilibrium modulus) describing the material condition after the initial deformation was much larger for three lower velocities than for three higher (impact) velocities. The increase in the peak force response along the increase of deformation velocity shows typical viscoelastic behaviour of apple flesh.

Keywords: *Apple, Mechanical impact, Stress relaxation, Maxwell model*.

THE INFLUENCE OF POTASSIUM FERTILIZATION AND IRRIGATION ON THE YIELD AND HEALTH STATUS OF JERUSALEM ARTICHOKE (*HELIANTHUS TUBEROSUS* L.)

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Abstract

The objective of this study was to evaluate the effects of soil potassium (K) fertilization (150, 250 and 350 kg K2O ha^{-1}) and irrigation on the fresh and dry matter yield of aerial biomass and tubers, tuber quality and the health status of tubers and leaves in three cultivars (*Topstar, Violette de Rennes* and *Waldspindel*) of Jerusalem artichoke – JA (*Helianthus tuberosus* L.). A field experiment was conducted in the Agricultural Experiment Station in Tomaszkowo (53º42'N, 20º26'E, NE Poland). Topstar had the highest total tuber yield and aerial biomass yield. The total tuber yield was not affected by an increase in the fertilizer rate to 350 kg K_2O ha^{-1}. The greatest increase in the aerial biomass yield was noted in response to the fertilizer rate of 150 kg K_2O ha^{-1}. Irrigation increased the yields of tubers and aerial biomass by 59% and 42% on average, respectively. A phytopathological analysis demonstrated that fungi of the genera *Alternaria, Fusarium* and *Epicoccum* were most prevalent on JA leaves. *Alternaria* and *Fusarium* fungi were more frequently isolated from leaves innon-irrigated treatments. Fungi of the genera *Penicillium, Fusarium, Alternaria, Botrytis* and *Rhizopus* predominated on JA tubers. *Fusarium* species were isolated from tubers in all irrigated plots, whereas they were less prevalent in non-irrigated treatments.

Keywords: *Jerusalem artichoke, fertilization, irrigation, yield, fungi.*

Acknowledgement: The results of our study were published in an article entitled: *"The Effects of Potassium Fertilization and Irrigation on the Yield and Health Status of Jerusalem Artichoke* (*Helianthus tuberosus*L.) "Bogucka B., Pszczółkowska A., Okorski A., Jankowski K. in the Agronomy-Basel 2021, 11, 234. DOI 10.3390/agronomy11020234

EVALUATION OF GRAPEVINE WATER DYNAMICS BY SAP FLOW AND TRUNK DIAMETER MEASUREMENTS UNDER MEDITERRANEAN CLIMATE

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Abstract

The climate of the Douro Demarcated Region, NE Portugal, typically Mediterranean, is characterized by hot and dry summers, frequently inducing abiotic (radiative, thermal and water) stresses in grapevines. These harsh environmental conditions result in low soil water availability and high vapour pressure deficits, with impacts on the crop physiological processes. Increasing challenges in water management are thus imposed, becoming increasingly essential tools to assist the winegrowers in the evaluation of the grapevine water dynamics, particularly in the most critical period of the vegetative cycle (maturation). In this context, the present study aimed to assess the water dynamics of mature Touriga-Nacional vines (red variety) by trunk diameter (using Linear Variable Differential Transformer) and sap flow measurements, in the Upper Douro sub-region. Complementary, weather conditions, soil moisture, leaf area index and leaf water potentials were measured during the growing season. The results obtained showed a clear diurnal variation of the trunk diameter (TDF), with the three phases clearly defined (contraction, recovery and increment), particularly in the period prior to veraison. These fluctuations tended to decrease over the maturation, in response to an increase in the vapour pressure deficit and a decrease in soil water availability. The variations in sap flow showed a similar trend in seasonal terms. Slight sustains or even increases in SF and TDF were found after water supply by deficit irrigation, but tended to decrease between events, in agreement with decreased (more negative) leaf water potentials. Nocturnal rehydration and stomatal mechanisms were associated with these responses. The study pointed to the usefulness of both automated and non-destructive techniques in assessing the grapevine water dynamics under harsh pedoclimatic conditions.

Keywords: *Douro Demarcated Region, Plant-based sensors, Water management, Vitis vinifera.*

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IMPORTANCE OF COFFEE PROCESSING TECHNIQUES ON COFFEE SENSORY PROFILE

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Abstract

From centuries, the coffee planting, processing and consumption keep an ancient ritual in order to obtain high quality of coffee drink and its products. Worldwide, a great demand of coffee and caffeine products is known leading to a quickly rate of production and consumption. Coffee characteristics depend on the geographic region, altitude, climate, and soil features and its farming. All interesting stages from the seeds growing, harvesting, production to the bean roasting, grinding and packaging methods are playing an important role to define the sensory properties of coffee beverage. Also, the bean species, general quality and their chemical composition influence the prepared coffee quality. Therefore, each manufacturer must exactness check all these parameters before distributing the products on the market. Some researchers have indicated that the fineness of grinding of coffee beans is of great importance, as it influences the sensory quality of drinking coffee. The sensory characteristics, namely the organoleptic and aesthetic values, are the ones which determine the customer to buy a coffee-based product. Besides, it is well known that the limited coffee drinking in adults has beneficial effect on human diseases due to some bioactive components based on antioxidants, enzymes, vitamins etc. The aim of this paper is to present different processing techniques, namely by directly sun-dried of coffee fruits, as natural drying method, wet method and natural pulping method to enhance and vary the coffee profile in terms of flavour, aroma and colour. The use of varied ways of coffee beans processing worlwide, having a local character as function of cultivation region, has defined the unique flavour of coffee beverage.

Keywords: *Coffee, Processing, Taste profile, Antioxidant, Flavour.*

INFLUENCE OF SOIL TYPES UPON SEED GERMINATION ON TOMATOES, PEPPERS, EGGPLANTS AND MELONS

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Abstract

In Romania, among the vegetable species, tomatoes occupy the largest areas (23,780 ha), bell pepper 17,900 ha, eggplants 4,810 ha and melons 4,340 ha. Vegetable yield is significantly influenced by the pedo-climatic conditions in the area and the cultivation technology applied. To carry out this experiment, 7 soil samples were used from different vegetable areas: Cluj, Iași, Neamț, Galați, Ilfov, Dolj and Arad. Soil samples were differentiated by nutrient content, pH value, electric conductivity, organic matter and water content. During the sowing -emergence period, plants can be attacked by various soil pathogens that cause seed rot and ,,damping off": *Pythium debaryanum, Phytophthora parasitica, Rhizoctonia solani, Sclerotinia sclerotiorum* and *Fusarium* spp. Their presence in soil samples was done by "trap plants" method. The experiments were performed in laboratory conditions, ensuring in the experimental period an average temperature of 21.6 ° C and an average humidity of 56.9%. In the soil samples, it was detected the presence of soil borne pathogens *Pythium debaryanum*, *Phytophthora parasitica* and *Rhizoctonia solani*, which cause seed rot and "damping off". On tomatoes, the number of emerged plants was between 25% (Arad) and 100% (Ilfov, Dolj). On bell peppers, the best emergence was registered in Dolj (92%), Galați (89%) and Iași (81%). On eggplants, the number of emerged plants was between 29% (Ilfov) and 100% (Galați, Dolj), and for melons it was between 4% (Arad) and 84% (Dolj).

Keywords: *soil pathogens, tomato, pepper, eggplant, melon*

GENE EXPRETION IN SUGAR BEET UNDER SALT STRESS

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Abstract

One of the important areas of the present crops research is to identify the genes for resistance to abiotic factors like salinization. In response to increasing of NaCl concentrations, increased expression level of genes controlling NHX-antiporters protein family, has been found. Four specific primers for the *NHX1, NHX4, NHX5* and *NHX5.1* antiporter's genes were used. RT-PCR by a Bio-Rad CFX96 thermo cycler was done. Relative level of *NHX4* and *NHX5* gene expression were assessed. Increasing of NaCl concentrations lead to increase in the gene expression levels of the NHX-antiporter proteins family was found. Increasing of *BvNHX1* and *BvNHX5* gene expression in foreign sugar beet hybrids Humber and Portland was also showed. Domestic samples of male sterile (MC17070) and multi-germ pollinator (Op18094) were also considered to be resistant genotypes. Domestic breeding materials maintained a relatively high expression of *APX1* gene under stress caused by critical NaCl concentration (210 mM), while stress by a 3mM NaCl solution, increased the specific activity of this enzyme in hybrid plants of Humber and MS-form of Ramon samples (MC17070) up to 48 E/gm. Sugar beet plant exposed to NaCl concentration of 70 mM, also showed a higher activity of ascorbate peroxidase, in Humber hybrid (68E/gm) and Ramon MS-form (115 E/gm). By using of NaCl solution at a concentration of 210 mM, the highest enzyme activity was found in MS-form plants 48 E/gm. Results obtained may allow selecting genotypes with increased resistance to salinity at the early stages of the breeding process.

Keywords: *sugar beet, salt stress, NaCl, BvNHX, APX1.*

MOLECULAR MARKERS FOR IDENTIFICATION OF GENES OF BREEDING-VALUABLE TRAITS OF *BETA VULGARIS* L.

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Abstract

The identification of haploid regenerants of sugar beet with sterile cytoplasm from the initial populations is of great theoretical and practical importance for breeding, as it facilitates the task of creating homozygous lines. The molecular genetic analysis of haploid regenerant plants identified single nucleotide polymorphism in the mitochondrial genome. This SNP made it possible to identify these microclones as fertile and sterile forms. All samples with fertile pollen, that is, in carriers of the dominant allele of the nuclear gene *Rf1*, nucleotide C was replaced by T, while in all haploid sterile forms only nucleotide C was detected. It has been established that DNA markers of the mitochondrial genome of sugar beet, belonging to the family of minisatellites *TR* (*TR1, TR3*), make it possible to identify MS- and O-type haploid microclonal plants with high efficiency. The informative value of the OP-S4 marker was established for the detection of monogerm forms. In our experiments, when carrying out PCR amplification of DNA in 11 samples of sugar beet obtained in vitro culture, with primer OP-S4, the presence of fragments of 1000 bp was revealed in all genotypes. In some samples (No. 1,2,3,10,11) the second fragment was synthesized, about 2800 bp in size. Genotypes No. 4 and No. 5, which, according to the breeders' data, were fertile, had weakly expressed DNA fragments. The combination of biotechnology and molecular genetics methods with traditional breeding techniques makes it possible to obtain new breeding material for the creation of new generation domestic sugar beet hybrids.

Keywords: *sugar beet, PCR, specific markers, monogerm, sterility, fertility.*

INVESTIGATION OF THE WAYS OF NEW HYBRID FORMS IN PEACH OBTAINING IN VITRO

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Abstract

Prunus persica (L.) Batch (Rosaceae) is the main commercial stone fruit crop in the world. In recent years, viruses, especially *Plum pox Potyvirus* (PPV), have caused great economic damage to stone fruits. The gene pool peach collection in the Nikita Botanical Gardens includes 717 cultivars and breeding forms. Tolerant peach cultivars 'Nikitskiy Podarok' and 'Persey' have been involved in hybridization. The objective of the presented work was to study the morphogenetic capacity in hybrid peach embryos and seedlings using biotechnological methods. Mature peach seedlings were obtained from embryos on Monnier culture medium. Addition of 0.75-1.0 mg L^{-1} BAP and 0.1 mg L^{-1} IBA in Gamborg & Eveleigh medium induced organogenesis in shoot segments. Microshoots of the hybrid form 'Progress' × 'Persey' demonstrated a high regeneration capacity. The number of formed adventitious buds and microshoots was up to 8.54 and 7.23 per explant, respectively. Callusogenesis and the formation of adventitious buds on Murashige & Skoog medium with 1.5-2.0 mg L^{-1} BAP + 1.5 mg L^{-1} IAA and 1.11 mg L^{-1} 2,4-D + 0.11 mg L^{-1} BAP were induced. Morphogenic callus on the cotyledons of the hybrid forms 'Clyde Wilson' × 'Nikitskiy Podarok' 'Jerseyglo' × 'Nikitskiy Podarok', 'Summerglo' × 'Nikitskiy Podarok' was observed. Cryopreservation methods for the cultivars 'Nikitskiy Podarok', 'Persey' and hybrid forms 'Persey' × 'Nikitskiy Podarok', 'Progress' × 'Persey', obtained under *in vitro* conditions, have been developed.

Keywords: *Prunus persica L., breeding forms, in vitro, embryoculture, cryopreservation.*

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FORMATION OF PEA SEEDLINGS INFLUENCED BY FULVIC ACIDS AND FOLACIN

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Abstract

Fulvic acids, along with humic acids, are an essential component of the humin of the soils. They improve nutrition, participate in the activation of biochemical processes of plants and protect them from adverse environmental conditions. The aim of the study was to investigate influence of fulvic acids produced from plant raw materials and folate on the biometric parameters and biochemical compound of pea seedlings. Pea seeds were treated with solution of fulvic acids with concentration of 0.0025% and combination of fulvic acids with folate. The use of fulvic acids solution increased development dynamics and biomass of pea seedlings. The increase of the length of pea roots under the influence of fulvic acids was due to the activation of water uptake and cell stretching processes. The treatment of pea seeds with a mixture of fulvic acids and folate increased the content of soluble proteins in the aboveground mass (by an average of 59%) and in the roots (by an average of 34%) in comparison with the control and treatment with fulvic acids only. Fulvic acids increased the activity of peroxidase in the roots of pea seedlings, the more sensitive plant organs. The amount content of protein and peroxidase activity were shown to change in the course of interaction with fulvic acids and folate. It was concluded that changes in the content of soluble protein and peroxidase activity witness adaptation changes in pea seedlings, which facilitate normal course of metabolic processes and ensure regulation in plant as response on the stimulation effect of fulvic acids.

Keywords: *Pea seedling, Fulvic acids, Folate, Peroxidase activity, Soluble protein.*

FEATURES OF THE REPRODUCTION AND PROPAGATION SYSTEM OF SOME SPECIES OF THE CAMPANULACEAE FAMILY

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Abstract

Currently, one of the most important and serious problems is the preservation of the biodiversity of the plant world, because "... the threat to the preservation of certain species and ecosystems has never been as great as today, when population growth and the consequences of its economic activities lead to irreversible changes in the nature of our planet" (Andreev et al., 2001). In this regard, it becomes necessary to study the processes that ensure the reproduction and restocking of higher plants. Knowledge of reproduction processes is extremely important for solving many problems of botany, including the problem of preserving and increasing the biological diversity of plants, identifying the features of their adaptations during introduction, clarifying the taxonomy, etc. (Kordyum, 1978, 2010; Poddubnaya-Arnoldi, 1976; Shevchenko, 2001; Shevchenko et al., 2010; Lammers, 2007). Of no small importance are reproductive features also in the development of methods for rational use of natural resources and the introduction into culture of various economically valuable plants - medicinal, aromatic, ornamental. Since the reproductive biology of plants involves the study of a number of sequential and interconnected processes of the development of flower elements, the formation of generative structures, the peculiarities of flowering, pollination, seed formation and dissemination, knowledge of them makes it possible to establish the patterns of formation of reproductive elements, identify critical periods in reproduction, and develop methods for improving reproduction and propagation of rare plant species, etc. Comparative studies of reproductive biology and, in particular, plant embryology are widely carried out by researchers (Kamelina, 2009; Kamelina, Shevchenko, 1988; Shevchenko, Kuzmina, Miroshnichenko, 2020; Klank et al., 2010; Shevchenko, 2017; and others), but not all families have been studied in sufficient detail and deep. Many species of the Campanulaceae family, such as *Campanula sibirica* L., *C. talievii* Juz., *C. taurica* Juz., *C. alliariifolia* Willd., *Adenophora liliefolia* (L.) Ledeb. ex A. DC. (syn. *A. taurica* (Sukacz.) Juz., *Platycodon grandiflorus* (Jacq.) A. DC. deserve special attention. As a result of the studies of these species, common features of embryology and anthecology as well as individual features of their seed formation, were established.

Keywords: *family Campanulaceae, generative structures, anthecology, micro- and megasporangium, seeds formation.*

DNA-MARKERS AND GENETIC DIVERSITY OF *BETA VULGARIS* L.

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Abstract

DNA markers play an important role as a tool for detecting genetic variation among plants. The identification of the different genotypes of sugar beet is important when used as parental components. We present the results of studying the genetic variability and diversity of sugar beet using microsatellite (SSR) markers. By PCR reaction, genomic DNA of 30 genotypes was amplified using 13 microsatellite markers (Unigenes and Bvv). One SSR locus had from 1 to 11 alleles, which varied within from 50 to 1400 bp. The PIC value ranged from 0.65 (Unigene 24552) to 0.88 (Unigene 7492). The SPSS Statistics software calculated the genetic distances between MC - forms and fertilized pollinators, where the largest established genetic distance DN was 2.449. Based on the calculated genetic distances, clustering was carried out and a dendrogram was built displaying genetic relationships. Two main taxonomic groups have been identified, each with 5 and 2 clusters, respectively. Parental samples that are at a significant genetic distance from each other are proposed for use in creating heterotic hybrids. Based on the results of molecular analysis, multilocus genetic passports and barcodes of the studied parental forms have been also compiled, which allows them to be identified for further use in the breeding process. It has been shown that SSR markers are effective in analyzing the genetic relationships of sugar beet genotypes. These markers can be recommended as highly polymorphic in the study of the molecular genetic diversity of crops in order to obtain new genetic combinations for crossing.

Keywords: *sugar beet, SSR-markers, PIC.*

CONTENT OF BIOACTIVE COMPOUNDS IN BIOMASS OF NATURAL LAWN OF ARRHENATHERETALIA

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Abstract

Natural meadows and pastures represent the most important resource in the production of bulky fodder in the hilly and mountainous area of Serbia. Yield and quality of grass biomass mainly depend on a large number of factors, among which are primarily floristic composition, which implies a share of quality grasses and legumes. The paper analyzes the influence of NPK application of mineral fertilizers with different nitrogen levels, where (A0- non-fertilized, A1-N60:P40:K40, A2-N100:P40:K40, A3-N140:P40:K40), on the content of total phenol, flavonoids, chlorophyll a and b and carotenoids in the biomass of natural grassland of the order Arrhenatheretalia in the municipality of Raska. It was observed that the application of increasing doses of nitrogen fertilizer did not significantly affect the phenol content in grasses and other plants. However, in legumes, it is noticed that the variant with the highest dose of nitrogen had a significantly lower phenol content compared to the control variant. The content of flavonoids in grasses and legumes did not change significantly depending on the application of different nitrogen levels. Phenolic compounds are considered to play the greatest role in the biological activity of extracts and their presence contributes to the antioxidant activity of the plant. The content of chlorophyll in grasses on the examined grass did not change with the application of increasing doses of nitrogen in the experiment, while unlike chlorophyll, the highest content of carotenoids in grasses of natural grass Arrhenatheretalia was achieved with the use of the highest amount of nitrogen in experiment N140.

Keywords: *natural grasses, bioactive compounds, order Arrhenatheretalia.*

THE USE OF TRITICALE MALTS IN WORT PRODUCTION

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Abstract

Barley is a highly adaptable cereal grain and it is mostly used for malting purposes –its chemical composition and technological parameters are highly determinative for the beer quality. Nowadays, in brewing industry, in order to achieve specific organoleptic qualities as well as lower price of beer production, barley malt is often replaced with adjuncts - sources of starch, which are cereals like corn, wheat, triticale... Triticale, hybrid of wheat and rye, may give good quality malts, characterized by high extraction capacity and short saccharification time, but usage of triticale can give viscosous mash. The aim of this work was the investigation of wort production by the application of triticale malt, as the substitute for barley malt in grist. The analysis of two triticale varieties, NS Paun and Odisej, was performed along with micromalting and analyses of the produced triticale malts. During micromalting, steeping was performed evenly which led to desired degree of steeping (45.5%) in both triticale varieties. Produced malts of varieties NS Paun and Odisej, showed very high extract content (87.95 and 82.77% dry matter) and diastatic power (610°WK and 585°WK). Both triticale malts had increased wort colour, hence could be suitable for production of dark beer. Overall, our research showed that both triticale varieties had higher malt extract and higher diastatic power than typical values of barley malt, which indicated that they could be used as a partial substitute for barley malt in wort production.

Keywords: *Triticale, malt, wort.*

THE INFLUENCE OF ROOTSTOCK ON WINTER COLD HARDINESS, PRODUCTIVETY AND FRUIT QUALITY OF SWEET CHERRY CULTIVAR 'KORDIA'

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Abstract

The study researched the influence of five clonal rootstocks on the sensitivity of flower buds to frost damage during the period of ecological dormancy and production properties of sweet cherry cultivar 'Kordia'. The study was carried out during five years at an orchard located at the experimental estate "Radmilovac" of the Faculty of Agriculture in Belgrade. Cultivar 'Kordia' was grafted on the following rootstocks: 'Gisela 5', 'Gisela 6', 'Ma×Ma 14', 'Colt' and 'Oblačinska sour cherry'. Winter frosts occurred during the ecological dormancy on March 14th and 15th. The intensity of frost was –7 °C. The percentage of damaged and non-damaged flowers per fruiting branches was determined by counting (100 flower buds per tree were taken from each part of the canopy and fruiting branches). The highest damage of flowers buds had trees grafted on 'Oblačinska cherry', (an average 61.2% of flower buds), while the lowest had trees grafted on 'Ma×Ma 14', (an average 12.3% of total flower buds). The significantly higher sensitivity of flower buds had a short fruiting branch compared to long fruiting branch. Trees grafted on 'Colt' had significantly higher values of TCSA (31.2 cm^2). The highest yield per tree cultivar 'Kordia' had grew on rootstock 'Ma×Ma 14', while the lowest had on 'Oblačinska cherry', 6.5 kg and 2.5 kg respectively. The biggest fruits had trees that grew on 'Colt' (12.5 g), while the smallest had trees that grew on 'Gisela 5' (9.8 g). The highest productivity had trees grafted on 'Gisela 5', 'Gisela 6' and 'Ma×Ma 14'.

Key words: *Dormancy, flower bud, frost damage, yield, fruit quality.*

EFFECTS OF ROOT PRUNING ON GROWTH CONTROL AND FRUIT QUALITY OF APPLE CULTIVAR 'GALA SHNIGA'

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Abstract

The aim of this study wasto evaluate influence of different level intensity of root pruning on vigour and fruit quality of apple cultivars 'Gala Shniga'. Root pruning was done two weeks before buds burst, on one (treatment 1) and both (treatment 2) side of rows, at a distance of 30 cm from the trunk and depth of 40 cm. Non pruning rootstock trees was as control. The highest values of total length and number of shoots were found in control trees. Average lengthoh shoots ranged between 25.4 cm (treatment 2) to 32.4 cm (control). Total number of fruits per tree ranged between 137.4 (treatment 1) to 102.2 (control). The highest yield was found in trees in treatment 1 (14.6 kg), while the smallest was incontrol trees (11.6 kg). The percentage of marketable fruits ranged between 93% (control) and 84% (treatment 2). Also, control trees had significantly higher weight of fruits compared to treatment trees. Weight of fruits ranged between 153.3 g (treatment 2) to 165.g (control). The highest content of total soluble solids was found in fruits from treatment 2, while control trees had the lowest. Root pruning had strong influence to deacreasing vigour of trees, but on the other hand it significantly decreased productivity of trees and quality of fruits.

Key words: *apple, vigour, yield, fruits quality.*

EFFECT OF CALCIUM CHLORIDE ($CaCl_2$) ON THE QUALITY OF APPLE CV 'RED CHIEF' (*Malus* × *domestica* Borkh.) DURING STORAGE

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Abstract

The paper presents the two-year results of research regarding the impact of calcium chloride ('Stopit') on changes in morphometric properties of the fruit, firmness and the soluble solids content (SSC) in apple cv 'Red Chief', at harvest and during storage of fruits (60 and 120 days) in the regular cold chamber. Foliar treatments were performed in four replications during vegetation (on June 7th, July 2nd, July 20th, August 15th – in 2018; June 14th, July 5th, July 26th, August 16th – in 2019). The obtained results indicate that fruit weight was significantly influenced by the calcium treatment and storage duration, while fruit dimensions varied under influence of storage duration only. The firmness and content of soluble solids was changing under the influence by all tested parameters and interaction effect of the study year and calcium treatment as well as storage duration. In the first year, fruits had higher weight (190.4 g), dimensions and firmness (12.4 N), whereas the SSC content was significantly higher in the second year of the study (16.2 °Brix). The fruits treated with calcium chloride had higher firmness (10.3 N) and soluble solids content (14.2 °Brix), especially after storage of 60 and 120 days (14.9 and 15.1 °Brix) compared to the soluble solids content in fresh fruits (11.5 °Brix). The stated results were confirmed by the highest values of the SSC recorded in the second year of the study after 60 days of fruit storage (17.9 °Brix). Based on the obtained results, it can be concluded that foliar application of calcium chloride during vegetation can be an effective measure with which losses in quality of apple fruit during storage in the regular cold chamber can be avoided with no negative effect on consumer acceptability.

Keywords: *apple, calcium treatment, morphometric properties, soluble solids.*

FOLIAR APPLICATION OF ZINC IN THE PRODUCTION OF RED CLOVER SEED ON ACID SOIL

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Abstract

Zinc is an important microelement that enters into the composition of hundreds of enzymes and thousands of proteins in the plant and animal world. The aim of the study was to analyze the effect of foliar application of zinc in acid soil on the most important seed yield components and seed yield of selected red clover (*Trifolium pratense* L.) genotypes from Serbia and Bulgaria. The experiment was established in 2012 in Čačak (Serbia) on loessivized vertisol soil type with acid reaction (pH_{H2O} 4.8). Sowing was done at a distance of 70x40 cm. There were used four different genotypes of red clover, three of which were isolated from the local population and variety of K-39. For the analysis was used the second cut in the second year of cultivation. Two treatments were used: control - no fertilization and foliar treatment with zinc in the form of $ZnSO_4$ x $7H_2O$, at a concentration of 0.2%, using 1000 L ha^{-1} of water, at the stage of intensive plant growth. Foliar application of zinc had a positive effect on the number of stems per plant, the number of inflorescences per stem, the number of inflorescences per plant and the number of flowers per inflorescence. The negative effect of foliar application of zinc has been reported on the thousand seeds weight and the fertility of flowers at the genotypes originating from Bulgaria. A significant increase in seed yield per plant, under the influence of foliar application of zinc, was observed only in the variety K-39 (for 11.4 g $plant^{-1}$), which otherwise had the highest seed yield.

Key words: *foliar fertilization, red clover, seed yield, zinc.*

SCREENING WHEAT ROOT AND SHOOT VARIABILITY AT SEEDLING STAGE

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Abstract

Despite the regular occurrence of droughts during wheat development in south-eastern Europe, selection for root traits in breeding programs has been limited. A set of 101 wheat genotypes (including old and modern cultivars from the region and worldwide) were grown in optimum environment at the onset of two-leaf stage, 10 days after germination, in a hydroponic phenotyping system. This study aimed to characterize phenotypic variability in wheat root and shoot morphological traits at early vegetative stages and to determine the relationship among shoot and root traits. Phenotypic variation existed for both shoot and root traits, with a maximal 2.5-fold difference in shoot dry mass and over 3.0-fold difference in root dry mass, primary root length and root angle (measured between the first pair of seminal roots). Cluster analysis separated the genotypes into three major groups based on the same set of root traits. Strong positive correlations were identified for some key root traits (i.e., root length, root dry mass, and root specific weight) and shoot traits (i.e., shoot dry mass and shoot specific weight) ($P \leq 0.01$). A subset of 16 wheat genotypes with different/exceptional root and shoot characteristic have been chosen as parents for targeted crosses to produce new germplasm in wheat for improving tolerance to drought. In total, 14 crosses from 16 parents with available F1 seeds were obtained. Parents along with their F1 progeny will be evaluated for seedling root and shoot traits in a hydroponic trial under high-molecular weight polyethylene glycol (PEG)-induced stress and non-stress growing conditions.

Keywords: *root traits, shoot traits, early vigor, correlations, cluster.*

VARIABILITY OF GRAIN SPIKE INDEX IN WHEAT (*TRITICUM AESTIVUM* L.)

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Abstract

Grain spike index indicate wheat productivity and can be used as criterion in wheat selection in the wheat breeding program. Aim of this investigation is study of variability of grain spike index in wheat cultivars grown under different environmental condition. Ten genetically divergent winter wheat cultivars were included in two year investigation in field experiment in randomized block design in three replications. The seeds of varieties were sown at the distance of 0.10 m in rows of 1.0 m length with the distance of 0.2 m. For analysis of grain spike index determined in proportion of grain mass spike^{-1}/mass of spike, 60 plants in full maturity stage (20 plants per replication) were used. On the base of analysis of variance by using MSTAT C (5.0 version) and computed F-test values, differences among cultivars according to value of grain mass spike^{-1}, mass of spike and also, grain index of spike were established. In the first year of experiment mass of spike varied between 3.33 g (Morava) and 4.07 g (Sasanka), and in second between 2.78 g (Kosmajka) and 3.64 g (Somborka). The value of grain mass spike^{-1} in the first year varied in range from 2.66 g (Morava) to 3.22 g (Danica) and in the second year from 2.23 g (Morava) to 3.03 g (Somborka). In the first year the highest grain spike index was established 81.8% (Fortuna) and the lowest 75.7% in Ljubičevka, with average for all varieties 78.9%, while in the second year the highest grain spike index was 83.2% in Somborka and Sasanka, and the lowest 76.6% in Ljubičevka, with average value average of all varieties 79.9%. The different values of grain spike index indicate response of genotypes to environmental factors as well as interaction of genotype/environment.

Key words: *wheat, cultivar, variability, index of spike.*

MORPHOLOGICAL AND PRODUCTION CHARACTERISTICS OF DIFFERENT TOMATO HYBRIDS GROWN IN GREENHOUSES

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Abstract

The main aim of this research is to estimate the impact of greenhouse conditions on the expression of morphological and production characteristics of three tomato hybrids (Big Beef, Amati, and Toivo). The tomato was grown in a tunnel greenhouse without additional heating. Transplantation of the seedlings produced in pots was conducted in the first week of April. Monitoring of morphological and later production characteristics was performed every 10 days from early May to mid-July. The first harvest was conducted in the first week of June, while four flower branches were harvested by mid-July (the end of the experiment). The research included the analysis of the following plant parameters: plant height, leaf number per plant, leaf number between flower branches, stem thickness, earliness, fruit number per flower branch, fruit weight per flower branch and total yield per plant. Temperature and air humidity were continuously measured in the greenhouse and outside of it. At the end of the experiment, the greatest plant height was obtained by the hybrid Amati (179.4 cm), followed by Toivo (165.2 cm), and Big Beef (160.1 cm). Other morphological parameters showed a similar tendency. The realized differences were statistically significant. When it comes to earliness, the hybrids had the following harvest maturity: Big Beef, Toivo, Amati. The highest yield per plant was realized by the hybrid Big Beef (2.91 kg) and it was statistically significantly higher than the yield of the other two hybrids (Toivo 2.64 kg; Amati 2.52 kg). The hybrids differ significantly regarding their morphological and production characteristics. In the examined greenhouse conditions, Big Beef had the best results since its production characteristics were better than those of the other two examined hybrids.

Key words: *tomato, hybrids, greenhouse, plant height, yield.*

THE IMPORTANCE OF CUCUMBER SEEDLING IRRIGATION BY MEANS OF NUTRIENT SOLUTION

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Abstract

Due to their fast growth, young seedlings have high nutrient requirements. Modern seedling production systems, particularly those with the protected root system, recommend the increased frequency of nutrient application during the process. The optimal continuous nutrient availability is primarily provided by irrigating young plants using the appropriate nutrient solution concentration. The research conducted at the Faculty of Agriculture, University of Belgrade included cucumber seedlings, while its aims were to underline the impact of seedling fertilisation on the seedling quality and to find the optimal nutrient solution concentration for irrigating seedlings. The cucumber seedlings (Darina F_1) were grown in grow chambers at day/night intervals of 14/10h and air temperature of 25/18^{o}C. The seedlings were grown in 9-cm diameter pots (Teku), filled with the substrate TKS 1 (Floragard). After sprouting, the seedlings were irrigated using different nutrient solution concentrations of Fitofert Humistart fertiliser: 0.1%, 0.3%, 0.6% and 1%. The control variant was irrigated using pure water. The seedling period lasted for 22 days (after sprouting), after which the seedling quality was determined by measuring the plant height and stem height, stem diameter, leaf number, leaf surface per plant, as well as plant fresh weight. The cucumber seedlings grown in the control variant had a statistically significantly smaller plant height, stem height and stem diameter, a smaller leaf number and lower plant fresh weight. The seedling variants which were continuously irrigated using only the nutrient solution had the measured quality parameters which did not show statistically significant differences between the variants. On the basis of this research, it can be concluded that the seedling irrigation by means of nutrient solution had a positive effect on the seedling quality. Including the economic point of view, the recommended concentration of nutrient solution is 0.1%.

Key words: *cucumber seedling, irrigation, nutrient solution, seedling quality*.

IMPACT OF SUBSTRATE VOLUME ON THE CUCUMBER SEEDLING QUALITY

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Abstract

In the production of vegetable crops and flowers, the size of the growing space, i.e. volume of container cells or pots, has a direct impact on water and air properties of the substrate, nutrient availability, and consequently the plant growth. Reactions differ depending on the plant species. Plants belonging to the gourd family (*Cucurbitaceae*) have the root system which is very sensitive to mechanical injuries and which has weak regeneration abilities. Therefore, the volume of the substrate in which their seedlings will be grown is very significant in the seedling production. Finding the optimal substrate volume has an impact on the seedling quality and later on the production itself, but it is also very significant from the economic point of view. Therefore, studies were conducted at the Faculty of Agriculture, University of Belgrade with the aim to define the optimal substrate volume which would provide the seedlings of the highest quality in the shortest time possible. The cucumber seedlings (Darina F_1) were grown in grow chambers at day/night intervals of 14/10h and air temperature of 25/18^{o}C. The seedlings were grown in pots of different volumes: 100, 200, 300, 500 and 1000 cm^3. The pots were filled with the substrate TKS 1 (Floragard). The seedling period lasted for 22 days (after sprouting), after which the seedling quality was determined by measuring the plant height and stem height, stem diameter, leaf number, leaf surface per plant, as well as plant fresh weight. It was determined that the increase in the substrate volume led to the linear increase in the values of all measured seedling quality parameters. The differences between smaller substrate volumes (100-300 cm^3), as well as between the larger volumes (500 and 1000 cm^3) were not statistically significant. From the production and economic points of view, the most optimal substrate volume for the cucumber seedling production is in the range from 200 to 300 cm^3.

Key words: *cucumber, pots, substrate volume, seedling quality*.

YIELD OF SWEET PEPPER (*CAPSICUM ANNUUM* L.) DEPENDING ON FERTILIZATION MANAGEMENT

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Abstract

Unbalanced plant nutrition may cause a decrease in the yield of sweet pepper (*Capsicum annuum* L.). Therefore, the objective of this study is to examine the effects of different rates and combinations of composted beef manure (CBM) and mineral fertilizers (MF) on yields of sweet pepper. The trial was set during the 2018 in the experimental field of Agricultural Extension Service, Sombor in Vojvodina, Serbia. Following treatments were used in this experiment: T: Unfertilized control; T2: CBM 34 t ha^{-1}; T3: CBM 42 t ha^{-1}; T4: CBM at 34 t ha^{-1}+85 kg N ha^{-1}; T5: CBM at 42 t ha^{-1}+105 kg N ha^{-1}; T6: 140 kg N ha^{-1}+60 kg P ha^{-1}+125 kg K ha^{-1}; T7: 105 kg N ha^{-1}+84 kg P ha^{-1}+175 kg K ha^{-1}; T8: 170 kg N ha^{-1}+60 kg P ha^{-1}+125 kg K ha^{-1}; T9: 210 kg N ha^{-1}+84 kg P ha^{-1}+175 kg K ha^{-1}. The results showed that the highest yield fruit of first class was in the T5 (2.00 kg m^{-2}), while the lowest was found at the T1 (1.42 kg m^{-2}). Regarding fruits of the second class, significant differences in yield per hectare between applied treatments was not found. The participant number fruits of first class ranged from 91.10% to 93.65%. It can be concluded that application only of CBM or combination of CBM with MF, significantly increase the yield fruit of first class sweet pepper, therefore this fertilization methodology may be advantageously adopted in producers practice.

Key words: *Fruits of pepper, Capsicum annuum L., Fertilization strategy.*

ANTIOXIDANT ACTIVITY ESTIMATION OF INNER AND OUTER SEED FRACTIONS OF THE LEGUMES *VIGNA RADIATA* L. AND *GLYCINE MAX* L.

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Abstract

Legumes have multiple functions in sustainable agriculture, but also are a favourable ingredient of functional nutrition. Antioxidants in legumes have several beneficial physiological properties and provide protection against chronic diseases. In this study, we compared the antioxidant activities of the seed fractions (outer and inner) for two different legumes: mung bean (*Vigna radiata* L.) and soybean (*Glycine max* L). The antioxidant activity was estimated using a modified DPPH (2, 2-diphenyl-1-picrylhydrazyl) assay in a 96-well microplate. We showed that mung bean hulls possessed significantly higher ($p<0.05$) DPPH free radical scavenging activity (80.80 % ± 0.19) compared to their inner fraction (10.94 % ± 0.23), as well as to both fractions of the soybean. On the other hand, the soybean seeds' inner fractions (21.00 % ± 0.32) exhibited a significantly ($p<0.05$) higher activity than the hulls (8.78 % ± 0.71) and the inner fraction of the mung bean. The obtained results indicated that in each of the two analysed legume species, inner and outer seed fractions exhibited different antioxidant activities regarding to the elimination of the free radicals. The obtained results indicate that antioxidant capacity may be a useful indicator in the estimation of the quality of legume seeds as food and feed.

Keywords: *Antioxidant activity, Soybean, Mung bean, DPPH, Food quality.*

CHARACTERIZATION OF COLORED MAIZE SEED FRACTIONS USING FLUORESCENCE SPECTROSCOPY AND MULTIVARIATE ANALYSIS

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Abstract

In the present study, we used the Multivariate Curve Resolution-Alternating Least Squares (MCR-ALS) algorithm to analyse the excitation-emission matrices (EEM's) of various cultivars of colored maize (*Zea mays* L.) seeds and its fractions. The EEMs were recorded as a set, with the excitation ranging from 280 nm to 380 nm and the emission spectra ranging from 300 nm to 550 nm. The MCR-ALS analysis yielded two major fluorescence components for all of the analysed samples. Both position and shape of the component 1 (C1), varied among the samples. On the other hand, the position and shape were similar for the component 2 (C2). C1 could be used as a marker for discrimination of colored seeds and their fractions. The observed variations in C1 between the analysed seeds, based on the presence of their individual fluorophores, can be assigned to anthocyanins, proteins, and phenolics. In conclusion, the MCR-ALS analysis of the seed emission spectra have a great potential for the rapid and non-expensive characterization of various cultivars of colored seeds.

Keywords: *maize seed, fluorescence, Multivariate Curve Resolution-Alternating Least Squares.*

EFFECT OF DRYING TEMPERATURE ON ANTIOXIDANT ACTIVITY OF WHITE AND RED MAIZE (*ZEA MAYS* L.) SEEDS

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Abstract

Maize is the most commonly consumed cereal in the world. Its various compounds are associated with nutraceutical properties and health-promoting benefits. Therefore, maize seeds are considered to be functional food with high antioxidant activities. The drying conditions have a huge impact on maintaining the seed quality. This study aimed to evaluate the effect of temperature on the antioxidant activities of white and red maize (*Zea mays* L.) cultivars. A drying time of 1 h at a temperature of 45 °C was tested. The antioxidant activity expressed in percentages was evaluated as radical scavenging activity using the DPPH (2,2-diphenyl-1-picrylhydrazyl) reagent. The results revealed that the antioxidant activity of the dried white seeds (74.08 %) was not significantly different ($p>0.005$) with respect to the un-dried seeds used as control (72.6 %). Contrary, drying at 45 °C caused a significant ($p<0.005$) rise of antioxidant activity in the red-coloured seeds' being 85.95 % and 92.25 % before and after the treatment, respectively. The obtained results show that the antioxidant activity may be a reliable indicator for the estimation of the cereal seeds' quality, which is useful in the food industry and agriculture.

Keywords: *maize seeds, 2,2-diphenyl-1-picrylhydrazyl radical scavenging activity, oven-drying, quality.*

THE INFLUENCE OF THE VARIETY AND DIFFERENT DOSES OF NITROGEN ON THE GRAIN YIELD AND PROTEIN CONTENT IN TRITICALE GRAIN

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Abstract

Observed through agronomic and economic significance, cereals represent the most important group of field plants, and the protein content in grain is the most important chemical parameter of complex grain quality. The research was conducted in order to determine the influence of the variety and different doses of nitrogen on the grain yield and protein content in triticale grain. The experiment, set up according to a random block system in four replications on eutric cambisol soil in the north of Montenegro, included five varieties of winter triticale (Odyssey, Kg-20, Triumph, Rtanj and Tango). In addition to the control (variant without fertilization), four more fertilization variants were applied. The results of the research showed that the application of fertilizers has a significant influence on the values of the observed traits on the one hand, but also that the grain yield and protein content in the grain is largely conditioned by the genotype. In this regard, the highest average protein content in the grain had the variety Triumph in both tested years. The protein content of all tested varieties was significantly lower in the control variant compared to the fertilized variants. The highest grain yield in the first year had the variety Tango while the highest yielding variety in the second year was variety Rtanj.

Key words: *Triticale, Fertilization, Variety, Grain yield, Protein content.*

AZOTOBACTER, PSEUDOMONAS AND *BACILLUS* ISOLATES STIMULATE THE GERMINATION AND SEEDLING GROWTH OF *MELLISA OFFICINALIS*

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Abstract

The objective of this study was the isolation and characterization of *Azotobacter*, *Pseudomonas* and *Bacillus* species from the rhizospheric soil of *Mellisa officinalis* and to examine the effect of isolates application on the seed germination and seedling growth. Isolation, physiological, biochemical, and plant-growth-promoting activity characterization of isolates were done. Monitoring the effects of isolates application on seed germination and seedling growth were evaluated in controlled conditions. The number of germinated seeds, the shoot and root length of seedlings, vigour index and biochemical stress markers (lipid peroxidation intensity and total phenols) were measured. From the rhizosphere of plant 2 *Azotobacter* (denoted as A5 and A6), 5 *Pseudomonas* (denoted as P27, P28, P29, P55 and P56) and 6 *Bacillus* (denoted as B64, B65, B66, B67, B68 and B69) bacteria were isolated. *Azotobacter* isolates showed the ability to live in the condition of low (5) and high (9) pH. The isolates varied in terms of the utilization of carbon sources. Both isolates produced pectinase, hydrogen cyanide (HCN) and utilized organic and inorganic phosphorus. *Pseudomonas* isolates had optimal growth at 10 ºC and 37 ºC, and on medium with pH 5 and 9. All *Pseudomonas* isolates could produce pectinase, lipase, amylose, IAA, siderophores and HCN. All *Bacillus* isolates could grow on a medium containing 7% NaCl. Two isolates (B65 and B67) showed intensive growth on medium with pH 9. Only two isolates (B64 and B67) produced IAA, and all of them siderophores and HCN. *Bacillus* isolates (B64 and B67) increased, while other isolates reduced stress which was observed by lowering the amount of stress molecules in seedlings. The best effect on the seed germination had *Pseudomonas* (P28) and *Bacillus* (B65, B66) isolates. *Azotobacter* isolates had the greatest stimulatory effect on seedling growth.

Key words: *medicinal plants, plant-growth-promoting microorganisms, seedling, total phenols.*

HYBRID × LOCATION INTERACTION IN A MAIZE EARLY TESTING USING FACTOR ANALYTIC APPROACH

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Abstract

In early stages of maize breeding program, large number of new genotypes are grown in a set of field trial locations. The best ones are identified to move to the next stage so that in the final stages of breeding program small number of superior hybrids are grown in a pre-registration and post-registration field trials across set of locations. Field trials were conducted in a partially replicated design,each genotype with two replications per location at six locations in 2020. The experiments included 150 hybrids obtained by crossing different S2 progenies with an elite inbred tester. These field trials were conducted to identify the best performing genotypes using appropriate statistical model. The factor analytic (FA) model accommodates the heterogeneity of genetic variance for locations and heterogeneity of genetic covariance between pairs of locations. Assuming that data from our field trials had high degree of the heterogeneity, we applied the FA model approach which resulted in accurate prediction of the hybrid by location effects. The FA(1) was identified as the best fitting model explaining about 80% of the hybrid × location interaction. The resulted genetic correlation matrix indicates moderate to high positive association among the locations. Using the FA (1) model, the most promising genotypes in terms of grain yield and yield stability were identified.

Keywords: *Grain yield, Yield stability, Maize breeding, Early testing, Hybrid × location interaction, Factor analytic model (FA).*

AGRONOMIC PERFORMANCE OF ALMOND CULTIVARS IN SERBIA

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Abstract

Almond production in Serbia is very small. The main reason for this is the frequent occurrence of late spring frosts during flowering. Present study was carried out to evaluate phenological characteristics (flowering and maturity times), productivity, and characteristics of the nut and the kernel (nut weight and dimensions, shell thickness, weight of kernel, kernel share, oil and protein contents) in 13 almond genotypes of a different origin growing in the region of Belgrade. The average flowering time was the second half of March and the first decade of April. The flowering began first in 'Nessebar', 'Selection 25', and 'Tétényi kedvenc' (16th of March), and latest in 'Francoli', and 'Texas' (29th of March). Beginning of the fruit maturity was recorded in the range of 13 days, from August 15th ('Tétényi bőtermő' and 'Tétényi keményhéjú') to August 28th ('Glorieta'). The average productivity was the lowest in 'Glorieta' and 'Francoli' and the highest in 'Tuono'. In March 2017 late spring frost that significantly reduced yield in early flowering cultivars was recorded. Nut weight ranged from 1.95 g ('Budatétény') to 5.58 g ('Marcona'). Shell thickness varied from 1.71 mm ('Budatétény') to 5.06 mm ('Marcona'). Kernel weight was the lowest in 'Selection 25' (0.80 g) and 'Tuono' (0.81 g), and the highest in 'Texas' (1.30 g). Kernel share was the lowest in 'Selection 25' (16.03%), and the highest in 'Budatétény' (57.93%). Oil content ranged from 44.35% ('Glorieta') to 57.52% ('Budatétény'), and protein content ranged from 21.72% ('Budatétény') to 30.51% ('Selection 25'). Obtained results indicate that Belgrade region is suitable for growing of late flowering almond cultivars.

Keywords: *Prunus dulcis, flowering, maturation, productivity, nut and kernel characteristics, oil and protein content.*

VARIABILITY OF ZELENY SEDIMENTATION VOLUME IN BREAD WHEAT AND DURUM WHEAT FROM MULTI-ENVIRONMENT TRIAL

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Abstract

The Zeleny sedimentation volume (ZS) is lean upon the ability of the endosperm storage proteins to swell and flocculate in a lactic acid and propan-2-ol solution in the presence of the dye, manifesting positive correlations with gluten strength, bread-making quality, the cooking quality of pasta, bread-loaf volume. The aims of this study were to assess variability and components of phenotypic variation using multivariate analysis of variance (MANOVA) for ZS of 30 genotypes (G) of bread wheat and durum wheat. The field trials were conducted during 2010-2011 and 2011-2012 vegetation seasons (S) at the three locations (L) in Serbia: Rimski Šančevi, Zemun Polje, and Padinska Skela. ZS was determined by Near infrared spectrometry with the Infraneo analyser (Chopin Technologies, France), with calibration NF ISO 5529. ZS content varied from 39.41 ml to 67.12 ml for bread wheat, and from 37.40 ml to 48.33 ml for durum wheat. The Tukey (HSD) test showed 11 and 8 homogenic sub-groups for ZS in bread wheat and durum wheat, respectively. The descending sources of variation by its contribution to ZS were: G > L > G × L > L × S × G > G × S > S > L × S for bread wheat, and S > G > G × L > L > L × S × G > G × S > L × S for durum wheat. The relation genetic component of variance/component of variance genotype × environment interaction was 1.0 for bread wheat, and 0.48 for durum wheat.

Keywords: *Triticum aestivum ssp. aestivum, Triticum durum, Zeleny sedimentation, Multivariate analysis of variance (MANOVA), Components of phenotypic variance.*

EFFICIENCY OF HYDRO- AND OSMOPRIMING IN IMPROVING GARDEN PEA SEED QUALITY AND INITIAL PLANT DEVELOPMENT UNDER SALINE STRESS

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Abstract

Worldwide, agricultural productivity is exposed to increasing constraints in the form of abiotic stresses such as salinity which affects plant growth and development causing yields loss. Previous studies suggest that seed priming improves stand establishment under optimal and stressful environment, given that seed priming might improve seed germination and initial development by altering seed vigour. This research aimed to define whether various seed priming treatments could be a feasible strategy to improve garden pea (*Pisum sativum* L.) resistance to abiotic stress, namely to salinity. Four garden pea cultivars obtained from the Department for Vegetable and Alternative Crops, Institute of Field and Vegetable Crops, Novi Sad, Serbia were included. Seeds of the tested pea cultivars were primed in distilled water (hydropriming), -0.5 MPa polyethylene glycol PEG 6000 solution, and 0.5% KNO_3 solution for 24 hours at 25°C in dark. Non-primed seeds were taken as control. Seeds were submitted to germination test, using 120 mM NaCl to simulate salt stress. The energy of germination, germination, abnormal seedlings, shoot and root length, fresh and dry shoot and root biomass, and seedling vigour index were estimated. The results showed significant differences among garden pea cultivars and seed priming treatments for the assessed traits. Besides, the results also showed a positive effect of the tested priming treatments on the germination and initial growth of garden pea cultivars grown under saline conditions, but for hydropriming to a lesser extent than osmopriming. Findings point out that seed priming with KNO_3 and PEG solution could be considered as an efficient method to improve garden pea seed germination and initial growth under saline conditions.

Keywords: *garden pea, initial plant development, saline stress, seed priming, seed quality.*

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INTERACTION OF FERTILIZATION AND SOYBEAN GENOTYPE ON NUMBER OF PODS, WEIGHT OF 1000 GRAINS AND GRAIN YIELD

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Abstract

In the last few decades, new soybean varieties with different characteristics, grain quality and purpose have been created, contributing to its expansion and increase in the cultivation area. Thanks to good agronomic characteristics, soybean has found its place in sustainable production systems. In order to increase the yield and quality of grain in sustainable soybean growing systems, different foliar treatments with different active substances have been increasingly applied. The aim of the study was to determine the impact of the application of EM Aktiv with effective microorganisms on the number of pods per plant, weight of 1000 grains and grain yield of different soybean cultivars grown in an integrated cultivation system. The research was conducted in the period 2016-2019 in the experimental field of the Institute of Field and Vegetable Crops Novi Sad. Varieties from three maturing groups Galina (0 group), Sava (I group) and Rubin (II group) were grown. Variants of fertilization application were: T1 control, T2 EM Aktiv was applied to the soil before sowing 20 $l.ha^{-1}$, and later in vegetation 6 $l.ha^{-1}$ (the first foliar treatment in the phase of three to four trefoils and the second before flowering in the budding phase), T3 NPK 8:15:15 300 $kg.ha^{-1}$ in basic treatment and T4 combination of T2 and T3 treatments. On average for all three years of the study were found statistically significant differences between the variables in all properties. The highest values were determined when applying T4 treatment. The number of pods was 55.92, the weight of 1000 grains was 163.61 g and the yield was 4.240 $kg.ha^{-1}$. The cultivar Rubin (II maturing group) showed the highest values for all examined variables on average after all treatments.

Key words: *soybean, fertilization, effective microorganisms, yield.*

RAMAN SPECTROSCOPIC STUDY OF SUGARS IN SUNFLOWER HONEY SAMPLES FROM ČESTEREG (VOJVODINA, SERBIA)

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Abstract

Monofloral sunflower honey was harvested from the enchanting vast sunflower fields in the vicinity of Cestereg (Central Banat) serving as a rich source of floral nectar collected by honey bees. The aim of the study was to detect predominant sugars such as glucose, fructose, sucrose and maltose in sunflower honeyof known origin using Raman spectroscopy. The Raman spectra were recorded with XploRA Raman spectrometer from Horiba JobinYvon, on laser at a wave length of 785 nm. Several vibrational bands at 415, 514, 564, 622, 703, 769, 815 cm^{-1}, followed by 856, 914, 964, 1021, 1067 and 1123, 1260, 1360 and 1455 cm^{-1} could be identified as fingerprints of the major sugar constituents of honey, fructose and glucose, whereas sucrose and maltose bands have been suppressed. The highest intensity bandat 415 and its shoulder at 446 cm^{-1} are attributed to the C–C–O vibration of α- and β- glucose, respectively. The higher intensity signals at 514cm^{-1} could be assigned to the skeletal vibration of glucose and 622 cm^{-1} to the ring deformation of fructose, due to its highest content in the honey sample. Finally, the bands at 1123, 1260, 1360 and 1455 cm^{-1} were related to the C-O-H deformation of the glucose and sucrose, C-O-C cyclic alkyl ethers of the fructose, CH and OH bending modes of the glucose and sucrose and the symmetric deformation mode of CH_2 in fructose, respectively. This study confirmed that Raman spectroscopy can be applied for rapid determination of sugar contents of commercial honey.

Keywords: *sunflower honey, glucose, fructose, Raman spectroscopy.*

COULD CARBON DOTS ALLEVIATE COPPER TOXICITY IN MAIZE?

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Abstract

Copper (Cu) is an essential microelement in various processes in the cell wall, such as wall synthesis and loosening, but Cu excess due to human activities increase soil pollution and can induce harmful effects. Alleviation of Cu toxicity could be ameliorated in various ways such as adding organic compounds and cations (Ca^{2+}, Mg^{2+}). This study aimed to reduce Cu toxic effects using organic nanoparticles as potential nano-fertilizers obtained from folic acid. Carbon dots (CDs) are biocompatible and non-toxic nanoparticles with chemical affinity to some heavy metals. In this research, CDs were applied in two different concentrations - 167 mg/L and 500 mg/L with or without 5 μM Cu^{2+} during the growth of maize plants in hydroponic solution. Cu concentration in plants and parameters of secondary metabolism - total phenolic content (TPC) and total antioxidative activity (TAA) were measured. Results showed that CDs based on folic acid were transported through maize and were present in both roots and leaves after 7 day-treatment. Cu concentration in roots was higher in both Cu and Cu/500CDs treatments compared to the control. The application of CDs reduced Cu concentration at the root level, while no significant effect was observed in leaves. However, the application of CDs was not effective in the mitigation of the oxidative stress in both roots and leaves induced by excess Cu. CDs neither affected TPC and not alleviated the TPC increase caused by Cu. Also, CDs did not cancel the TAA increase induced by Cu in any of the applied concentrations. In the leaves, TAA increased in all treatments where Cu was present in the growth medium. There were no visual adverse effects on plants.

Keywords: *carbon dots, copper, maize, nanoparticles, toxicity.*

EFFECT OF ORANGE CARBON DOTS ON PHOTOSYNTHETIC PARAMETERS IN MAIZE

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Abstract

Plant nanobionics studies nanoparticles application toplants, which improves certain plant functions. Due to many limitations, plants use less photosynthetic capacity thanit is theoretically possible, so an increase in leaf photosynthesis canbe important for increasing crop yield. For this purpose, carbon dots (CDs) as organic, non-toxic nanoparticles with a huge potential for application can be used. They are a green alternative to metal nanoparticles. The main advantages of these nanoparticles are their easy preparation, high water solubility, biocompatibility, and photoluminescence. The main aim of this research was to investigate the effect of orange carbon dots (o-CDs), synthesized from citric acid and o-phenylenediamine as precursors, on photosynthetic efficiency increase in maize (*Zea mays* L.), as a model plant and agricultural species. We applied o-CDs in three different concentrations (1, 5, and 10 mg/L) by adding to the hydroponic growth solution or foliarly. The photosynthesis parameters (photosynthetic rate, transpiration rate, water use efficiency) and content of photosynthetic pigments (chlorophylla and b, carotenoids) were recorded. The results showed that the photosynthetic parameters' values were higher for foliar than for solution application. Amount of 1 mg/L o-CDs applied foliarly and 5 mg/L in solution increased photosynthetic parameters in leaves. The photosynthetic pigments were enhanced after o-CDs treatments. Finding that o-CDs have photosynthesis enhancing potential without harming plants opens new opportunities in their use in agricultural applications, such as increasing plant productivity.

Keywords: *carbon dots, maize, nanoparticles, photosynthesis, photosynthetic pigments.*

QUANTITATIVE AND QUALITATIVE CHARACTERISTICS OF WINTER BARLEY IN CONDITIONS OF SOUTHERN SERBIA

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Abstract

Production of barely is possible even at higher altitudes and wider latitudes, but it is most frequently grown in temperate climate (autumn and spring sowing), as well as in semi-arid subtropical climate (winter sowing). The aim of this paper is to present the quantitative and qualitative characteristics of three varieties of livestock feed winter barley, namely of the varieties *KG Zlatnik, Nonius* and *Amorosa*, as well as to draw conclusions about the best variety which is to be grown under tested conditions on the basis of fertility characteristics of the tested varieties. The experiment was conducted in the area of the city of Niš in the course of 2018 and 2019, according to a random block system with four replications and the basic plot size of 5 m^2. After the harvest, the grain yield from the basic plot was measured and converted into kilograms per hectar. The obtained results were processed by means of variance analysis. In the second year of research, due to favourable climatic conditions, the length of spikes in all varieties was bigger in comparison to the first year. The maximum length of spikes for both research years was measured for the variety *Zlatnik*, indicating an increase in the number of grains per spike, and consequently a higher total yield. On average, for all varieties in the experiment, 39 grains per spike were formed in the second year of research, which is six grains more per spike than in the first year of research. The largest number of grains per spike had the variety *Zlatnik*, which also had the largest spike length.

Keywords: *livestock feed winter barley, agro-ecological conditions, fertility traits, variety.*

FORAGE QUALITY OF PROMISING VETCH GENOTYPES

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Abstract

Preservation of genetic variability is very important, especially due to climate change and the need to adapt agricultural production to new conditions. Institute for forage crops Kruševac keeps a small collection of vetch genotypes (*V. sativa* L. and *V. vilosa* L.). Most genotypes are native to Australia and the rest originates from Serbia. In Serbia, common vetch is cultivated as a feed for ruminants and can be grown for different purposes as a pure crop or in mixtures with cereals. For both purposes, the quality and yield of green mass is very important. A small-plot trial was carried out in 2018 and 2019, at the experimental plot of Institute for forage crops in Kruševac, Serbia. Fifteen promising genotypes of common vetch (*Vicia sativa* L.) were examined for dry matter yield and green mass quality. The moment of green mass cutting, for each genotype, was at the stage of full flowering and the formation of the first pods. The following parameters of green mass were examined: dry matter yield (DM), crude protein (CP), crude ash (CA), crude fiber (CF), crude fat (CF), as well as acid detergent fiber (ADF), and neutral detergent fiber (NDF). Significant variability was obtained for all tested traits, except for the fat and ash content. Investigations of genetic variability of common vetch can be a basis of further investigations and improvement of new cultivars with desirable characteristics.

Key words: *common vetch, forage, crude protein, ADF, NDF*.

INFLUENCE OF GENOTYPES AND ENVIRONMENT ON EGGPLANT FRUIT LENGTH AND WIDTH

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Abstract

One of the goals in eggplant breeding (*Solanum melongena* L.) is higher yield, as well as adaptation to different environments. Our study included 20 different eggplant genotypes. The experiment was conducted at three different locations (Smederevska Palanka, Vranovo and Kusadak) using a randomized complete block design in three replications. The length and width of fruit were examined, characteristics important both for the shape and the weight of the fruit. Two-factors ANOVA determined a statistically significant influence of genotype and locality for fruit length and width. Average fruit lengths ranged from 134.86 mm (K19) to 246.07 mm (K38). The mean value of fruit length from the Kusadak locality was significantly ($p<0.01$) higher than the general average (181.58 mm), and significantly longer fruit length was recorded in 10 genotypes: K6, K13, K15, K16, K21, K22, K22, K25, K36 and K39. The highest average fruit width (120.05 mm) was recorded in genotype K19 and differed significantly in relation to the average values of other observed genotypes. The lowest average fruit width was recorded in the K38 genotype at Smederevska Palanka and Kusadak localities (54.33 mm and 54.82 mm). According to AMMI analysis, the least stable locality in terms of fruit length was Kusadak, while the most stable was Smederevska Palanka with an AMMI stability coefficient of 7.00. The most stable genotype was K3 (0.76). The locality Smederevska Palanka was the most stable for fruit width (9.50), while the most stable genotype was K7 (0.28). The least stable locality was Vranovo.

Keywords: *eggplant, environment, fruit length, fruit width, AMMI analysis.*

BIOPRIMING: A SUSTAINABLE SUPPORT FOR CROP ESTABLISHMENT

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Abstract

Crop yields are highly depended on germination and early stages of plant growth. Numerous priming techniques are being developed aimed to improve germination. Biopriming represents a sustainable approach based on seed treatment in bacterial suspension of selected plant growth promoting strains. One of the most promising plant growth promoting bacteria is *Azotobacter chroococcum*. The aim of the research was to evaluate the effects of *A. chroococcum* F8/2 as a biopriming agent on germination of various cultivable plants: basil, white mustard, cucumber, tomato, wheat, canola, and soybean. After surface sterilization, seeds were bioprimed in the bacterial suspension (10^7CFU/ml). Uninoculated seeds represented control treatment. Germination test was conducted with 100 seeds per treatment and the germination was monitored for 7 days. Following germination parameters were determined: germination percentage, germination index, mean germination time, vigor I, vigor II, length and dry biomass of the seedlings. The bacterial inoculation caused higher germination percentages of cucumber, tomato, wheat and soybean. The highest increase in germination index was observed in wheat (an increase of 19.8%). Tomato and basil were the only plants where vigor I was not increased by inoculation. Generally, the most favorable effects of *A. chroococcum* biopriming were observed in wheat where vigor I was increased more than twice, and vigor II was higher by 75.4% in inoculated seeds. The results indicate a significant potential for *A. chroococcum* use in biopriming. The observed effects of seed priming on germination parameters were crop-specific, with the most prominent potential in wheat biopriming.

Keywords: *Azotobacter chroococcum, Biopriming, Germination, Seedlings' growth.*

BLUE LED LIGHT PROMOTES SOMATIC EMBRYOGENESIS FROM THE LATERAL ROOTS SECTIONS OF SPINACH (*SPINACIA OLERACEA* L)

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Abstract

Light and gibberellins (GAs) are essential for the induction of somatic embryogenesis in spinach. In the present study, the influence of light of different spectral qualities on the induction of somatic embryogenesis from the apical root sections of spinach seedlings was tested. The explants grown under blue light (B, emission maximum at 460 nm), provided by Light-emitting diodes (LED), exhibited the highest regeneration frequency (57.8%±0.36) and the mean somatic embryo (SE) number per explant (5.02±0.04) for eight weeks of cultivation on SE-induction medium supplemented containing 20 μM α-naphthaleneacetic acid and 5 μM GA_3. The explants cultivated under white (W, 300-720 nm) LED or light provided by fluorescent lamps (FL, 380-680) produced a two times lower number of SEs per explant, while the explants grown under red (R, 630 nm) LED light or in darkness (D) failed to regenerate SEs. Considering that light greatly affects the level of GAs in plant tissues, and GAs are indispensable for SE induction in spinach, the expression profiles of genes encoding the key enzymes that catalyze the final steps of bioactive GA biosynthesis (GA20-oxidase and GA3-oxidase) and inactivation (GA2-oxidase) were tested in the explants grown under B, W or FL light. Surprisingly, no significant differences in the expression levels of these genes were observed among the treatments during of SE induction, indicating that light triggers SE induction by other mechanism, not including alterations in the expression of the aforementioned genes. Further research is needed for better understanding of the mechanism of SE induction by light.

Key words: *spinach, somatic embryogenesis, gibberellins, LED lights, gene expression*.

SUITABILITY OF FIELD PEA : OAT AND COMMON VETCH : OAT MIXTURES FOR ENSILING

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Abstract

The practice of preserving green crops by fermentation as silage has increased dramatically in recent years. Successful ensiling can be difficult due to numerous problems such as: high moisture content, high feed buffer capacity, insufficient amount of fermentable carbohydrates etc. The aim of this investigation was to determine the suitability for ensiling field pea:oat and common vetch:oat mixtures grown at different seeding rate and harvested at different stages of growth. Field pea, common vetch and oat were grown in pure stands and in the mixtures of 75:25, 50:50 and 25:75 ratios and harvested at three stages of plant development: beginning of field pea and common vetch flowering, forming the first pods in field pea and common vetch and at the forming green seeds in 2/3 field pea and common vetch pods. The most favorable ratio of sugar and buffer capacity for the established level of dry matter in the examined crops was stated in pure oat crop. The results obtained in the mixtures of field pea and oat are based on the ratio of sugar and buffer capacity and can successfully ensile in all three examined relations of germinating grains of field pea and oats. The highest sugar content (182.1 g kg^{-1} DM) and the highest buffer capacity were determined in the 50:50 field pea:oat mixture at the pea flowering stage of development. The least favorable ratio of sugar and buffer capacity was found in pure common vetch.

***Keywords**: field pea, common vetch, ensiling*

EVALUATION OF KANAMYCIN AND CEFOTAXIME EFFECTS ON PROLIFERATION, MORPHOLOGY AND GERMINATION RATE OF SOMATIC EMBRYOS IN *CENTAURIUM ERYTHRAEA* RAFN

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Abstract

Centaurium erythraea Rafn is medically significant plant with a great potential in treating multiple gastrointestinal tract diseases. Although widely spread, *C. erythraea* is now listed as endangered species due to extensive exploitation, so there is a need to deepen knowledge of existing and developnew *in vitro* techniques for its mass propagation. Somatic embryogenesis (SE) is the most effective way for centaury *in vitro* regeneration. In addition to possessing great multiplication rate, regeneration via SE is also convenient for genetic transformation since somatic embryos offer genetically uniform starting material with less somaclonal variability. Furthermore, the ability of somatic embryos to undergo secondary SE, a process in which new somatic embryos are initiated from somatic embryos, makes them a suitable target tissue for transformation. We have recently established secondary SE in *C. erythraea* for the first time and our next step is to develop a transformation method using somatic embryos as starting material. Choice of the correct type and optimal concentration of decontamination and selection antibiotics is crucial in order to obtaina high germination rate and normal morphology of somatic embryos as a prerequisite for successful transformation. Therefore, we evaluated antibiotic sensitivity of untransformed somatic embryos, using different concentrations of cefotaxime and kanamycin as decontamination and selection antibiotics, respectively, and appropriate concentrations were determined. These conclusions were furthermore verified by visual observations of secondary somatic embryos number, their morphology as well as germination rate of embryos grown on media containing various antibiotics concentrations.

Keywords: *Centaurium erythraea, secondary somatic embryogenesis, Agrobacterium-mediated transformation.*

STABILITY OF WHEAT CULTIVARS FOR YIELD AND QUALITY COMPONENTS IN DIFFERENT AGROECOLOGICAL CONDITIONS

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Abstract

Stability of grain yield, 1000 kernel weight and sedimentation value were analyzed in 10 winter wheat cultivars (Perfekta, Toplica, KG-52/3, Merkur, Vizeljka, Talas, NS 40S, Zvezdana, Javorka and Pobeda), created in different breeding institutions in Serbia. The experiment was carried out during 2019/2020 in two localities: Centre for Small Grains in Kragujevac and Institute for Forage Crops in Kruševac, Serbia. The analyses of variance showed highly significant differences in grain yield, between genotypes, investigated localities, as well as their interaction. The influence of the locality did not show statistical significance on the expression of 1000 kernel weight and sedimentation value. The highest average values were recorded by Perfekta for grain yield, Zvezdana for 1000 kernel weight and KG-52/3 for sedimentation value at both localities. The AMMI model was used for analysis of genotype × environment interaction. The most stabile cultivars were Vizeljka, NS 40S and Perfekta with values above the average for grain yield. Cultivars Talas, KG-52/3 and Javorka showed the highest stability for the 1000 kernel weight. Cultivar Javorka had the highest, while Talas and KG-52/3 had the lowest average values for this trait. Vizeljka and KG-52/3 were the most stable genotypes for sedimentation value, with KG-52/3 achieving the highest values of the observed trait at the level of the entire experiment. Both analyzed locations had high interaction value for all three analyzed traits.

Keywords: *wheat, yield, quality, AMMI, stability.*

EFFECT OF ROOTSTOCKS ON GRAFTING WATERMELON PLANT GROWTH, YIELD AND QUALITY

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Abstract

During the last two decades, the production of watermelon in Serbia is based on the use of grafted seedlings. Grafting aims to increase the yield and maintain the quality of fruits, as well as resistance to stress caused by biotic and abiotic factors. The watermelon (*Citrullus lanatus* (Thunb.) Matsum and Nakai) cultivar Top Gun F1 was grafted onto Emphasis F1 and Strong Tosa F1 commercial rootstock hybrids and *Lagenaria siceraria* as simple rootstock accepted by many local farmers, for late open field growing conditions. Nongrafted and selfgrafted plants were used as control. The percentage of grafting in the seedling period ranged from 81% (Strong tosaF1 / Top Gun F1) to 91% (*Lagenaria siceraria* / Top GunF1). Grafted seedling plants had a higher height and thickness of the stem, as well as a larger leaf area compared to nongrafted and selfgrafted. It has been confirmed that grafting watermelons produce a larger number of larger fruits. The highest number of fruits per plant (2,2) was recorded in the variant *Lagenaria siceraria* / Top Gun F1, with an average weight of 6.510 g. Hybrid rootstocks contributed to a uniform number of fruits per plant 1,7-1,8 with an average weight of 7.450-7.700g. Stress caused by unfavorable climatic conditions and pest attacks affected the number of fruits per plant 0,9-1,1 of nongrafted and selfgrafted plants, with a weight of 3.200-3.910 g. Detrimental effects were not determinates in fruit quality such as fruit index, rind thickness and sensory properties (has been proven by the results of panel tasting) on grafted plants, but differences according to the rootstock being used were evident. Grafted plants improved plant growth and yield without any harmful effects on fruit quality.

Keywords: *watermelon, grafting, rootstocks, yield, quality*.

EXPRESSION ANALYSIS OF COLD INDUCED GENES IN EARLY DEVELOPMENTAL STAGES OF MAIZE

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Abstract

Earlier sowing is one of the most promising approaches in crop production for battling the negative ramifications of climate change, such as the increasing temperatures and drought during spring and summer. Since earlier sowing implies exposure of plants to low temperatures in early developmental stages, finding ways of estimating low temperature tolerance of different crops, including maize, during these stages is very important. Certain genes are known to play an important role in the low temperature response during later stages of development (V3 and beyond), but less is known about their expression profiles and roles during the earlier stages. Hence, the expression of five low temperature induced genes (*FAD2*, *FAD6*, *FAD7*, *ZmCDPK1* and *ZmDREB2A*) was analysed in 5-day old seedlings and compared to plants in V3 stage. The experiment was performed with seedlings of two genotypes (tolerant and sensitive), under optimal (25°/20°C) and low (8°/10°C) temperature conditions. Sampling was done at different time points during the treatment (6h and 24h) and used for RNA extraction, cDNA synthesis and qPCR expression analysis. Results showed that the expression of these genes differed based on the developmental stage. In most cases, the expression was decreased in the 5-day old seedling stage both after 6h and 24h of treatment, while in the V3 stage it was increased at both time points. The significant difference between gene expression in these two developmental stages suggests that different genes are involved in the response to low temperatures in stages prior to V3, and this will be further studied.

Key words: *Maize, Low temperature stress, Gene expression, Cold induced genes, Early developmental stage.*

ENERGY EFFICIENCY OF THE MINERAL FERTILIZER APPLICATION IN CEREAL PRODUCTION

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Abstract

Cereal grains have represented the principal component of the human diet for thousands of years. Modern cereal productioncan not be imagined without the use of mineral fertilizers, particularly in terms of better utilization of biological potential of the yield of growing plants. The aim of this study was to evaluate the energetic effciency of wheat and barley production, with special reference to the share of the use of mineral fertilizers in total energy consumption. Input data and yield of wheat and barley fields were collected in the experimental trials in Serbia. Results showed that total energy inputs of wheat and barley fields were 22178.04 and15921.16 $MJ \cdot ha^{-1}$, respectively. Total energy outputs for wheat and barley fields were 80037.83 and 104496.08 $MJ \cdot ha^{-1}$, respectively. The results obtained indicate that mineral fertilizers claim a share of the total energy consumption in cereal production ranging from 49.19% in barley to 52.01% in wheat. Specific energy input, energy output–input ratio (energy use efficiency), energy productivity and net energy gain were 5.13 $MJ \cdot kg^{-1}$, 3.61,0.19 $kg \cdot MJ^{-1}$ and57859.79$MJ \cdot ha^{-1}$in wheat system and 2.75 $MJ \cdot kg^{-1}$, 6.56, 0.36 $kg \cdot MJ^{-1}$ and 88574.92 $MJ \cdot ha^{-1}$ in barley system, respectively. According to the results, it seems that barley production is more efficient from different aspects of energy consumption compared to wheat in the studied region. In general, production in barley fields was more sustainable than wheat production because, in view of ecological indices such as amount of energy use and renewable energy consumption, it was more environment-friendly production.

Keywords: *Cereal production, mineral fertilizers, energy consumption, energy efficiency.*

GERMINATION OF DIANTHUS SEROTINUS SEED ORIGINATING FROM PLANTS PRODUCED BY MICROPROPAGATION

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Abstract

Dianthus serotinus Waldst.& Kit. is important endemic, endangered and decorative species. It has a status of extremely endangered species in Serbia and it is under legal protection. *D. serotinus* can also be used as an ornamental, drought tolerant, low-maintenance species. To enable its *ex situ* and *in situ* conservation, it has been successfully propagated *in vitro*, in the Laboratory at the Faculty of Forestry in Belgrade. The obtained plants were acclimatized, flowered and produced seeds. The seed germination was tested immediately after collecting and after two years of storage. The effect of different disinfection methods on seed germination was also evaluated: treatment with 3.5% NaOCl solution for 15 minutes, treatment with *Allium sativum* L. extract containing bioactive allicin, and treatment with a fungicide Previcur (control). Immediately after collection, the seed germination (92.2 - 94.3%) and germination energy (90.0 – 91.1%) were high, and NaOCl and *A. sativum* extract had no effect on germination. However, after two years of storage, treatment with NaOCl significantly increased germination rate (90.0%) compared to control (81.1%), while *A. sativum* extract had an adverse effect (68.9%) on seed germination.

Keywords: *endangered plants, generative propagation, NaOCl, Previcur, allicin, Allium sativum.*

EFFECTS OF RED AND FAR-RED LIGHT ON SEED GERMINATION OF PLATANUS × ACERIFOLIA (AITON) WILLD.

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Abstract

Platanus × *acerifolia* is a widely planted ornamental tree, suitable for planting in cities, especially as a roadside tree because it is very tolerant of atmospheric pollution and root compaction. Despite producing large amounts of seeds, it is usually propagated by cuttings. However, the London plane produces a large amount of seeds and generative propagation is also possible, thus helping in a preservation of genetic variability which enables plane tree populations to adapt and to survive in heterogeneous environments in changing climate conditions. The aim of this study was to evaluate the effects of red and far-red light on seed germination, considering that seeds are small and possibly photoblastic. The seeds were collected in April and imbibed for 72 or 103 hours, followed by exposure to white light, red light, far-red light or their combinations before placing seeds on germination. The seeds in the control treatment were kept in dark. Despite expectations, obtained results show that London plane seeds are not photoblastic. Furthermore, the highest germination rate (41.0%) was obtained in a control treatment (seeds kept in dark). However, dark conditions did not promote germination because there was no significant difference in a germination rate among seeds exposed to white light, red light or far-red light.

Keywords: *London plane, photoblastic seed, germination, photosensitivity, far-red light.*

GERMINATION OF BUDDLEJA DAVIDII FRANCH. SEED EXPOSED TO RED AND FAR-RED LIGHT TREATMENTS

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Abstract

Buddleja davidii a vigorous shrub with an arching habit and honey-scented lilac to purple flowers, widely used as an ornamental plant. There are many varieties and cultivars of this species, and they are propagated vegetatively. However, it produces viable seed and it has been recorded as naturalized or even invasive species in many countries. For this reason, testing germination of the seeds collected from the plants growing in the Belgrade area in Serbia can help to evaluate their potential to spread by self-sowing. The seeds of summer lilac are positively photoblastic and the aim of this study was to investigate the effect of red and far-red pulse of 5 minutes on seed germination. The obtained results show that a reversible effect of red and far red light on seed germination is partially expressed. The highest germination rate was recorded after 5 minutes of red light pulse (29.3%), red light treatment followed by far-red light resulted in much lower germination (9.3%). However, treatment with far-red light followed by red light reversed the effect of far-red light, but germination percentage was lower, only 14.7%.

Keywords: *summer lilac, butterfly bush, photoblastic seed, photosensitivity, far-red light.*

GERMINATION OF PAULOWNIA FORTUNEI (SEEM.) HEMSL. SEED AFTER DIFFERENT RED AND FAR-RED LIGHT TREATMENTS

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Abstract

Paulownia fortunei is a fast-growing, ornamental deciduous tree with large, fragrant pink flowers that has recently become popular for growing in green areas in Serbia, as well as on plantations for timber production. Dragon tree paulownia tolerates a wide range of soils, including soils contaminated with heavy metals pollution and it endures urban conditions well. The elite trees of dragon tree paulownia growing in the Belgrade area, well adapted to local conditions, were selected as a source for production of planting material for urban coenoses and specific-purpose plantations of this species. The dragon tree paulownia can be propagated by seed or vegetatively by cuttings. It produces a light-sensitive seed that requires light to germinate. For this reason, the aim of this research was to evaluate the effects of a red and far-red light pulse of 5 minutes on seed germination. Obtained results showed that red light (R) pulse had a positive effect on germination compared to far-red (FR) light treatments and that effect of red light could be reversed by far-red light and vice versa. The germination was higher after red light treatment (R – 10.5%, R-FR-R – 29.0%) than after far-red treatment (R-FR – 1.0%, R-FR-R-FR – 0.3%). However, the best result (77.5%) was recorded with seeds that germinate in white light conditions, without R or FR treatments.

Keywords: *dragon tree paulownia, Fortune's empress tree, photoblastic seed, photosensitivity, far-red light.*

GERMINATION OF RUDBECKIA FULGIDA VAR. SULLIVANTII 'GOLDSTURM' SEED UNDER DIFFERENT TREATMENTS

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Abstract

Rudbeckia fulgida var. *sullivantii* 'Goldsturm' is a low-maintenance perennial species that produces numerous flower heads with golden-yellow rays and brownish-black center disks, from July to October. It can grow on different soils and can endure drought once established. It can also be used as a cut flower. It is often grown in green spaces in Serbia. Usually it is propagated vegetatively, by division or cuttings. Also, it produces a large amount of seed and generative propagation is possible, but plants do not come true from seed. However, the seed is small and it can easily be dispersed at long distances by wind, spreading this plant in surrounding natural habitats. For this reason, the aim of this study was to examine the germination of *Rudbeckia* 'Goldsturm' seeds and thus determine the probability of its naturalization. Treatments included pre-chilling for 5 days at 3°C, followed by the exposure to white light, far-red light, red light or their combinations, considering that seeds were small and possibly photoblastics. Although pre-chilling treatment was recommended for *R. fulgida* according to ISTA rules, our results showed that germination of seed in all treatments that included pre-chilling was very low (below 3%). The highest germination rate of 14% was obtained in a control treatment where seed was not pre-chilled and germination was performed in white light conditions. The seed kept in dark did not germinate. Obtained results indicate that *Rudbeckia* 'Goldsturm' have no potential to establish its population in natural habitats by seed dispersion, and it can be included in a Green list of non-invading alien taxa that can be grown in Serbia without a risk of becoming invasive.

Keywords: *Black-eyed Susan, far-red light, photoblastic seed, photosensitivity, germination.*

EFFECTS OF THE SOWING DATE ON RELATIONSHIPS OF MORPHOLOGICAL PROPERTIES OF MAIZE EARS

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Abstract

The aim of this study was to observe effects of the sowing date on the relationships among morphological properties of maize ears. The trial was set up in Zemun Polje in 2019 and encompassed five sowing dates with the initial one on April 1, and then on every 10 days until May 10 (S1, S2, S3, S4, S5). Three inbred lines (L1, L2, L3) were used as a material. During sowing, seeds were classified according to their size into small (6.5-8.4 mm), large (8.5-11 mm) and the primary seed fraction (6.5-11 mm). The parameters for the following morphological ear traits were determined under laboratory conditions: ear weight, ear length, ear thickness, cob weight and the grain yield. Obtained results indicated the significant contribution of all factors in expression of observed traits, as well as the significance of the interactions. The inbred L1 was the most stable genotype for the ear weight and the cob weight. The ear length and the ear thickness varied the least in all genotypes. The initial sowing dates (S1 and S2) were the most important for the ear weight. The third sowing date was the most important for the ear length (19.81cm) and the ear thickness (5.94cm). The highest cob weight was recorded in plants sown on the fifth sowing date (S5). The LSD tests showed that the differences in the morphological traits of ears of different sowing dates were significant between S5 and the remaining four sowing dates ($p<0.05$). Various fractions used in sowing affected all traits.

Key words*: agroecological conditions, cob, trait variability.*

LOW NICOSULFURON AND MESOTRIONE RATES INFLUENCE ON VARIOUS CROPS

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Abstract

Nicosulfuron as sulfonylurea and mesotrione as triketone are some of the most used herbicides for weed control in maize. The potential off-target movement and plant injuries of these herbicides were evaluated in a bioassay under controlled conditions. Both herbicides were applied in rates of 0.005X, 0.001X, 0.05X, 0.01X, 0.1X, 0.25X, 0.5X, 1X, 2X, and 4X, where X corresponds to 60 g ai ha^{-1}, and 120 g ai ha^{-1} for nicosulfuron and mesotrione, respectively. Seven species were tested: lettuce, oil pumpkin, oilseed rape, paprika, soybean, sunflower, and tomato. After applications, plants were returned to the greenhouse and grown for more 21 days and following parameters were evaluated: visual injuries, leaf area, height, and dry biomass. All data were converted into a percentage of reduction compared to untreated control. The data were subjected to a non-linear regression analysis by four-parameter log-logistic model using R statistics. According to obtained results, rates of 0.03 and 0.06 X for nicosulfruon and mesotrione, respectively influenced all measured parameters. The most sensitive species to both herbicides was lettuce. The rates of 4.8 g and 6.1g of nicosulfruon reduced biomass by 80% in tomato and oil pumpkin, while 0.2 g and 0.9 g of mesotrione reduced biomass by 80%. Since our results have reported significant injuries following low herbicide rates, herbicide drift must be mitigated in order to prevent potential negative influence on the environment.

Key words: *herbicide drift, plant damages.*

THE EVALUATION OF THE STABILITY OF SOME ZP MAIZE HYBRIDS BASED ON THE GENOTYPE × ENVIRONMENT INTERACTION

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Abstract

Stability of yield or of any other trait depends on the ability of a given cultivar to response to changes in the environment, which is also referred to as phenotypic plasticity. The analysis of a genotype × location interaction is necessary to obtain information on the stable performance of genotypes. This paper presents results of the genotype (G) main effect and the genotype by environment (GE) interaction, genotype plus genotype by environment interaction (G × GE) biplot analysis of a multi-environmental trial with eight maize hybrids of the FAO maturity group 600 and six different locations in Serbia conducted in 2018. The objective was to determine the effects of genotypes, six environments and their interactions on grain yield and to identify stable maize genotypes. The trial was set up in a randomised complete block design with three replications in each environment. The combined ANOVA indicated that the main effects of environments, genotypes and the genotype by environment interaction were highly significant. The G × GE effects were further partitioned using a GGE biplot model. In the FAO maturity group 600, the first mega-environment contained environments E6 (Požarevac), E5 (Pančevo) and E2 (Bečej) with a check G7 (ZP EXP1) producing the highest yield. The mega-environment contained environments E4 (Sremska Mitrovica) and E1 (Zemun Polje) with the most yielding hybrid ZPSC 606. Genotypes G8 (ZP EXP2) and G7 (ZP 707) are considered to be the "ideal" genotype in terms of performance and stability.

Key words: *AMMI stability value, GGE biplot, genotype, environment, maize.*

THE GRAIN YIELD STABILITY ANALYSIS OF THE ZP COMMERCIAL MAIZE HYBRIDS BASED ON MULTI-ENVIRONMENTAL TESTING

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Abstract

The Maize Research Institute, Zemun Polje (MRIZP) has been working intensively on maize breeding for 75 years and today occupies an important position in maize seed market in Serbia and region. Some of the main characteristics of the crop production in Serbia are many different environmental conditions (soil, weather) and farmers with very different crop management practices. Considering that genotype x environment interaction plays an important role in grain yield performance of maize, testing in a wide range of environments is necessary for precise evaluation of maize cultivars. Every year, the Marketing Department of the MRIZP conducts multi-environmental testing of the bestselling and the new promising commercial maize hybrids (so-called ZP hybrids) and uses these results for recommendations to farmers. The main goal of this research was to evaluate the grain yield and its stability of the ZP commercial maize hybrids and based on these results to determine which hybrid could accomplish the best its potential in which growing conditions. Seven maize hybrids (ZP 427, ZP 555, ZP 560, ZP 600, ZP 606, ZP 666 and ZP 707) of different maturity groups (FAO 400 – FAO 700) were grown at 99 locations in Serbia during three years (2018, 2019 and 2020). Based on the grain yield data, the stability analysis was performed using linear regression model proposed by Eberhart and Russel (1966). The mean grain yield ranged from 9.823 t/ha to 10.691 t/ha in the hybrids ZP 427 and ZP 606, respectively. The values of regression coefficient (b_i) differed between hybrids and ranged from 0.845 in the hybrid ZP 427 to 1.0951 in hybrid ZP 666. The results were compared, and the adaptation of the evaluated hybrids to different environments and growing conditions were discussed. Based on the results certain conclusions were made.

Key words: *maize hybrids, grain yield, genotype x environment interaction, multi-environmental testing, grain yield stability.*

YIELD COMPONENTS OF BIOMASS AND GRAIN OF SOYBEAN IN RESPONSE TO THE USE OF BIOFERTILIZER

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Abstract

In recent years, biofertilizers have received more attention as eco-friendly and sustainable agricultural practice to boost crop production. This research included application of bio-fertilizer Coveron, containing mycorrhizal fungi, *Trichoderma atroviride* and rhizosphere bacteria, on the yield components of biomass (in reproductive growth stage) and grain (in full maturity stage) of soybean (*var*. Selena). The field experiment was set up in the Maize Research Institute „Zemun Polje“, during 2020. Treatments included application of biofertilizer Coveron prior to sowing, and control (without Coveron). Harvesting for biomass yield - BY, as well as morphological traits (plant height - PH, weight of underground plant - WP, number of nodes per plant - NN, number of pods per plant - NP) were measured in R4 growth stage. At full maturity, grain yield and its components were recorded, including: PH, WP, NN, NP again, as well as grain yield - GY, number of seeds per plant - NS, seed weight per plant - SW, and 1000-seed weight - TSW. Results showed that biofertilizer significantly influenced biomass yield (31.36 t ha^{-1} and 26.22 t ha^{-1}, with and without Coveron, respectively), while results for GY were opposite (higher grain yield was obtained in no-treated soybean, but without statistically significant difference at p=0.05). In regard to other examined parameters for biomass, biofertilizer positively affected all of them, increasing PH, WP, NN and NP values. However, situation in phase of full maturity was a slightly different. While Coveron increased the values of PH and NN, other parameters were greater in control. Correlations among the investigated traits were also estimated, and significant positive correlation between GY and NP, NS and SW was determined. Accordingly, further research should be focused on the potential biofertilizer use to increase biomass and grain yield.

Keywords: *plant height, number of nodes, number of pods, number of seeds, seed weight.*

INFLUENCES OF HERBICIDE TREATMENTS AND ROW SPACES ON THE MAIZE GROWTH AND YIELD PARAMETERS

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Abstract

The herbicide application and crop arrangement modifications are measures that can reduce weed abundance and support maize to compete over weeds. The aim of the investigation was to test and compare the growth and yield parameters of maize cultivated with standard and narow distances and with pre- and post-emergence chemical weed control. The experiment was conducted in the MRI Zemun Polje, Belgrade, during 2014-2016. Maize hybrid ZP 388 was grown with 50 cm and 70 cm row spacing, i.e 59,500 and 83,333 plants ha^{-1}, respectively. The herbicide treatments included: control, a pre-emergence treatment of S-metolachlor+mesotrione and the post-emergence application of nicosulfuron+mesotrione. Six weeks after herbicides application, the biomass of whole maize plant (BMP) was measured, while the chlorophyll content (CH), leaf area (LA) and the leaf area index (LAI) were evaluated at the stage of fully developed maize plants. The Harvest index (HI) and grain yield (GY) were measured at harvest. The herbicide application caused significant differences in all maize parameters. The BMP, CH, LA, LAI, HI and GY were the highest when the post-emergence herbicides treatment was applied (25.22 g, 61.16, 4545.76 cm^2, 3.22, 0.46 and 9.56 t ha^{-1}, respectively) and the lowest in control (15.21 g, 49.35, 3356.02 cm^2, 2.39, 0.41 and 5.87 t ha^{-1}, respectively). Maize cultivation with 70 cm row distance was significantly advantageous for LA, HI and GY, (4316.33 cm^2, 0.45 and 9.19 t ha^{-1}, respectively) in comparison to the 50-cm row distance (3940.96 cm^2, 0.43 and 7.36 t ha^{-1}, respectively). The post-emergence herbicide application and standard 70-cm row distance are beneficial for the growth and yield of the hybrid developed under agro-ecological conditions of Serbia.

Key words: *Cropping practices, Maize, Herbicides, Leaf area, Yield.*

GRAIN YIELD IN MAIZE HYBRIDS OF DIFFERENT FAO MATURITY GROUPS

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Abstract

A two year field trial with ten promising native maize hybrids for grain production (Maize Research Institute Zemun Polje, Institute of Field and Vegetable Crops, Novi Sad), FAO maturty groups 300-600, was set up in the vicinity of Kragujevac (Lužnice site, 44 ° 06 ′ N, 20 ° 49 ′ S, 240 m a.s.l.), on brown forest soil type. The aim of this study was to recommend hybrids for specific agroecological conditions. In both years, sowing was performed at the end of April, of eight rows per elementary plot, at a row distance of 70 cm, and 18 to 25 cm within row, depending on recomended number of plants, in three replicates. During the experiment, standard agricultural measures were applied, excluding irrigation. Owing to a much larger amount and more favorable distribution of precipitation, especially in the critical developmental phases (tasseling - fertilization), the average grain yield of all maize hybrids in 2018 was almost three times higher than in 2017. The most noticeable reaction of hybrids to environmental factors was recorded in the hybrid NS 548 which, as one of the hybrids with the highest yield in 2017, in 2018 had a yield significantly lower than other hybrids. Hybrids ZP 560, ZP 606 and ZP 666 in both years belonged to the group of hybrids with the highest grain yield.

Keywords: *maize, hybrid, grain yield.*

"HOPE IN HOPS" -PROJECT OF UTILIZING THE EXISTENT AND CREATING A NOVEL GENE POOL TO REVIVING HOPS PRODUCTION IN SERBIA

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Abstract

Hop (*Humulus sp*. L.), is an ingredient in beer brewing, and an herbaceous plant, grown in temperate regions. In EU, it covers about 26.500ha giving 50% to 63% of total world production. Hop was introduced in South Bačka in 1770. The 1920's were "Golden age" of hops in Vojvodina (Serbia), covering 8000 ha, and it was exported, too. By 1950, one of the largest hops production regions in the world was reduced to 143 ha. During 1960's, hops in Vojvodina covered 1500 ha. By 2018, hop was downed to 20 ha. Hop growing was closely related to Slovak community in Vojvodina. The disappearance of hops weakened their cultural heritage, because a number of national customs was connected to hops production and utilization. The "HopeInHops" project is to revive and propel hops scientific research, breeding and production. "HopeInHops", examines the existent hops genetic variability, and broadens it by procuring novel genetic variation. Expected results would be to selecting the promising genetic variability for hops breeding program renewal; Biodiversity preservation through collecting, cataloguing, examining hops genetic diversity; The target would be hops genetic variability for industrial production and processing, for small family breweries and for organic and sustainable production systems. The impacts are: Establishing contemporary hops research and breeding program; Preservation of national heritage of Slovaks in Serbia; Economic development by hops production renewal; Development of rural areas; Development of small business; Organic and sustainable agricultural production; To form a core group to carry out and link up education, research, regional/international cooperation and economy in hops production.

Keywords: *Hop, Biodiversity, Production, Development, Serbia.*

BIOFUNGICIDES IN THE PRODUCTION OF HEALTHY SEEDLINGS

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Abstract

In order to introduce proper use of new disease-fighting agents into a country, certain relevant principles, requirements and criteria prescribed by the Forest Stewardship Council (FSC) must be observed, primarily with respect to measures of assessment and mitigation of risks, the list of dangerous and highly dangerous pesticides with the possibility of alternative protection. One of the main goals of the research is adjustment of the protective measures to the FSC policy through selection of eco-toxicologically favourable fungicides. We study alternative protection on the occurrence of mass dieback in oak forests seedlings in Central Serbia (caused by *Microsphaera alphitoides* Griff. et Maubl.) with various dosages of AQ-10 biofungicide, which is a pelleted formulation of conidia of *Ampelomyces quisqualis* Ces. ex Schlechtend. Simultaneous testing has been conducted on the efficacy of a chemical sulphur-based preparation. The results of the research have demonstrated that AQ-10 biofungicide can be used as a part of integrated disease management programmes as an alternative. The best results in suppression of oak powdery mildew have been attained through use of sulphur SC in the concentration of 0.5%, while very satisfactory results have been obtained by use of AQ-10 biofungicide in the highest dosage of application (70 g/ha). The number of treatments has been proven to have no significant impact on increased efficacy of the bio-preparation, or in other words, it shows that besides the application dosage, the high efficacy of the bio-preparation depends primarily on proper timing of the application.

Keywords: *Alternative protection, Quercus robur, Central Serbia.*

IN VITRO ANTIOXIDANT ACTIVITY OF *SATUREJA KITAIBELII* WIERZB. EX HEUFF. SUBCRITICAL WATER EXTRACT

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Abstract

Satureja kitaibelii Wierzb. ex Heuff. or Rtanj tea is an endemic species of the Carpathian mountain chain on the Balkan Peninsula. It grows in Eastern Serbia, Northwest Bulgaria, and Southwest Romania. As traditional remedy, it is used for treatment of different stomach discomforts such as pains in the lower abdomen, upset stomach, diarrhoea and nausea, for the regulation of the menstrual cycle and fertility, for muscle relaxation, and in the treatment of the upper respiratory tract infections. Therefore, the aim of this research was to examine the phytochemical composition and antioxidant activity of *S. kitaibelii* in form of subcritical water extract (SWE). HPLC analysis of SWE of *S. kitaibelii* showed the presence of ten compounds in a total concentration of 89.33 mg/g of the extract. It was demonstrated that the polarity of subcritical water was the most selective for extracting syringic acid (37.88 mg/g), caffeic acid (18.06 mg/g), and epicatechin (10.04 mg/g). Flavonoids like rutin, luteolin, and apigenin were the least abundant in this extract (<2 mg/g). Additionally, this study investigated *in vitro* antioxidant activities of *S. kitaibelii* SWE by five antioxidant assays. Four assays present radical scavenging activity while the last assay indicates transitional metal reduction. The highest scavenging abilities were observed against superoxide anion and ABTS•+ radicals (437.35 and 412.09 μmol TE/g), followed by lipid radicals (69.61 μmol TE/g), and DPPH• (32.28 μmol TE/g). In the case of ferric ion reducing ability, a value of 118.19 μmol TE/g was noticed. This study supplied new information about the phytochemical profile and bioactivity of *Satureja kitaibelii* extract. Phenolic compounds from *S. kitaibelii* were successfully extracted using subcritical water. The obtained extract contained a considerable amount of phenolic antioxidants, and the most abundant phenolics were syringic acid, caffeic acid, and epicatechin.

Keywords: *subcritical water extraction; Satureja; phenolic compounds.*

INFLUENCE OF GEOGRAPHICAL ORIGIN ON ANTIMICROBIAL ACTIVITY OF *ROSMARINUS OFFICINALIS* L. ESSENTIAL OILS

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Abstract

As a worldwide cultivar, *Rosmarinus officinalis* L. (rosemary) in form of essential oils, extracts, and spice possesses many pharmacological properties due to different biological activities. Interestingly, the chemical profile of rosemary depends on regionality, seasonality, environmental conditions, agronomic conditions, and its own varieties. Therefore, this research aimed to investigate the impact of geographical origin on the antimicrobial activity of the essential oils. Screening of the *in vitro* antimicrobial activity was performed by the discdiffusion and microdilution methods. It can be noticed that Russian oil (RF) showed far better antimicrobial potential in comparison to Serbian oil (SRB). In the case of RF, the maximum inhibition zone of 40.00 mm was registered for all tested microorganisms, except for *Pseudomonas aeruginosa* (21.33 mm) and *Aspergillus brasiliensis* (33.00 mm) where the activity might be estimated as moderate to high. These results can indicate the possibility of using RF as a natural ingredient in combating the microbial and antimycotic resistance toward antibiotics. A high antimicrobial activity (above 30.00 mm) was also observed for SRB against *Escherichia coli*, *Staphylococcus aureus*, and *Saccharomyces cerevisiae*. However, this oil showed low to moderate activity against *P. aeruginosa*, *B. cereus*, and *A. brasiliensis*. It could be noted that SRB showed good antimicrobial activity against bacteria (MIC $\leq$ 50%), while for the tested eukaryotic microorganisms the MIC value was above 50%, which could be related to their more complex cell structure in comparison to bacteria.

Key words: *Rosmarinus Officinalis, essential oils, geographical origin.*

ASSOCIATION AMONG SUNFLOWER YIELD CONTRIBUTING TRAITS IN VARIOUS ECOLOGICAL CONDITIONS

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Abstract

Sunflower (*Helianthus annuus*) is one of the most important oil crops in the world. The objectives of this study were to perceive the association between important oil yield related traits and to evaluate different types of sunflower genotypes on the basis of these selected traits. The experiment was carried out during three years at experimental field Rimski Šančevi. Testing included 30 different sunflower genotypes developed at Institute of Field and Vegetable Crops, Novi Sad, Serbia. The associations among the observed traits and genotypes evaluation were studied using genotype-by-trait biplot analysis. Associations between observed traits were very similar in all three years of testing. Biplot revealed strong positive association among oil yield, seed yield and head diameter, as indicated by the acute angles between their vectors. These vectors were perpendicular to vector of oil content, pointing to zero association. Oil yield was weakly positively associated with thousand seed weight, seed set efficiency and number of flowers. Total absence of association in all three years was recorded between number of flowers and thousand seed weight. Obtuse angle between vector of seed set efficiency and vectors of oil content and number of flowers pointed to negative association. Weak to strong positive association was detected between oil content and number of flowers, and also, between seed set efficiency and thousand seed weight. These associations could be very useful for better understanding oil yield and its complexity and for selecting appropriate genotypes for further breeding process.

Keywords: *Helianthus annuus, Oil yield, Associations, GT biplot.*

INFLUENCE OF LOCATION ON PHENOLOGICAL AND PRODUCTION PROPERTIES OF RASPBERRY (*RUBUS IDAEUS* L.)

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Abstract

The paper presents two-year results of testing the phenological and production characteristics of Vilamet raspberry cultivar, grown in 2 localities near Ivanjica (Southwestern Serbia). The localities are about 25 km away. The soil conditions in both localities are similar, but the climatic conditions are significantly different, primarily due to the difference in the altitude of the localities. Location 1 is placed at 600 m above sea level, and Location 2 even at 985 m above sea level. At the end of the experiment, similar production results were achieved at both localities (fruits of similar size; a small difference in terms of yield). On the other hand, the differences in phenological parameters were significant. The start of leafing in Location 1 was on April 1 and in Location 2 even 28 days later - on April 28. The beginning of flowering differed by 26 days.A similar regularity was observed concerning the beginning and end of fruit ripening. As the harvest lasted 34 (Location 2) or 35 days (Location 1), it can be concluded that there was very little overlap of harvest at these 2 locations.It is of great importance because the harvest is one of the biggest costs in raspberry production and one of the most difficult tasks for an organization. Also, the offer of fresh raspberries on the market can be extended.

Keywords: *raspberry, altitude, flowering, harvest.*

TOTAL FLAVONOID CONTENT IN EDIBLE PARTS OF SELECTED *ALLIUM* SPECIES

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Abstract

Allium species are popular and very common vegetable in the human diet. In addition to giving the smell and taste of food, alliums are well known as plants with potential healing effects. Flavonoids from alliums have been demonstrated to have numerous phytotherapeutic effects on human health. In this paper, the content of total flavonoid in the edible parts of selected *Allium* species (*Allium sativum* var. *saggitatum* L. – bulb; *A. fistulosum* L. – whole plant; *A. ampeloprasum* var. *ampeloprasum* L. – bulb; *A. nutans* L. - leaves; *A. odorum* L - leaves.; *A. schoenoprasum* L. - leaves) was investigated, with the aim of assessing the quality of these species. For this purpose six samples of fresh plant material were prepared and extracted with 80% methanol (MeOH). The content of total flavonoid (TFC) was determined by the standard spectrophotometric aluminum chloride method, and the obtained results were expressed as mg of quercetin equivalent (QE) per gram of fresh weight. TFC was in range from 0.14 to 0.79 mg/g QE. The lowest content of TFC was determined in *A. fistulosum,* while the highest content of TFC was obtained in *A. schoenoprasum*. In *A. sativum* var. *saggitatum* L. and *A. ampeloprasum* var. *ampeloprasum* L. the presence offlavonoids was not determined. In this study, it was found that the flavonoid content was higher in alliums in which the aboveground parts were used in the diet. In agricultural practice, research is aimed at examining the impact of various agrotechnical measures, especially fertilization, in order to increase the content of secondary metabolites with therapeutic effects in edible parts of plants.

Key words: *Allium, edible parts, human health, total flavonoid*.

HYDROXYCINNAMICACID DERIVATIVES: POTENTIAL ANTIOXIDANTS IN RARE GROWN *ALLIUM* SPECIES FROM SERBIA

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Abstract

The modern lifestyle imposes the need to discover and introduce foodstuffs that have nutritional and medicinal value into the food chain. The genus *Allium* includes a great number of species. The most studied species are onion, garlic and leek, for which there is evidence of beneficial effects on human health. Investigation of other, rare grown species of this genus, offers the possibility of expanding the range of food to vegetable species with potentially enriched chemical composition. Bearing in mind that the antioxidant properties of food are an important parameterofits quality, this paper aimed to examine the content of hydroxycinnamic derivatives (HCAs), as natural antioxidants, in two *Allium* species - *A. schoenoprasum* (chives) and *A. nutans* (blue chives), grown under different foliar application of selenium - Se (0, 10, 20, 30 g per ha). The total HCAs content was determined by spectrophotometric method, measured the absorbance at 525 nm. The obtained results are expressed as mg equivalent of chlorogenic acid (CGAE) per g of fresh weight. HCAs was in range 0.18 to 0.39 mg/g CGAE for *A. schoenoprasum*, and from 0.18 to 0.94 mg/g CGAE for *A. nutans*. The presence of HCAs indicates the potential antioxidant activity of the investigated species and justifies further detailed research with the aim of identifying other bioactive components that manifest beneficial effects on human health.

Key words: *Allium nutans, Allium schoenoprasum, antioxidant properties, HCAs.*

RESULTS OF TESTING OF SEEDERS WITH DIFFERENT SOWING MECHANISMS IN MAIZE SOWING

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Abstract

Sowing of maize is a very important agro-technical intervention, bearing in mind that the omissions during sowing cannot be corrected later by other agro-technical measures. The quality of sowing maize, in addition to the quality of agro-technical works before sowing, also depends on the quality of work of sowing aggregates. Sowing aggregates for sowing maize must ensure the correct horizontal and vertical distribution of seeds because only the correct arrangement provides the plants with optimal vegetation space and the possibility to achieve high yields. A successful sowing unit, in addition to satisfactory quality of work, should also have high work productivity, i.e. achieved effects, because optimization is successful only with operational tests. The paper presents the results of testing the quality of work and performance indicators of units for sowing maize with different sowing mechanisms. The tests were performed in the agroecological conditions of central Serbia - Kragujevac area and included the assessment of the distribution of corn seeds along the length as well as the achieved effects concerning the projected depending on the defined parameters for mechanical sowing unit mechanism, under-pressurized sowing unit mechanism, and sowing unit with an over-pressurized mechanism. The obtained results show that the best longitudinal seed distribution was achieved when sowing maize with sowing mechanism type because the percentage of distances that were > 0.5 <1.5 of the theoretical grain spacing within the row was over 80% and the worst with mechanical sowing mechanism type A (mechanical) when these values were the lowest. The achieved effects concerning the projected ones varied in the range from 73.52% of the sowing unit type B to 83.41% as measured with the sowing unit type C. The increase in the speed of movement during sowing significantly affected the quality of the longitudinal distribution of corn seeds.

Keywords: *Seed drill, Quality, Longitudinal seed distribution, Performance.*

CHEMICAL AND PHYSICAL PROPERTIES OF SOIL UNDER PLANTATIONS OF OBLACINSKA CHERRY IN TOPLICA DISTRICT

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Abstract

The paper presents the results of testing the chemical and physical properties of soil, performed in the accredited laboratory of the Department of Agriculture and Food Technology in Prokuplje, in 2018 on 25 average soil samples and in 2019 on 25 average soil samples. We analyzed the chemical properties: pH values in H_2O and in 1M KCl, humus by Kotzmann method, total nitrogen calculated from humus, readily available potassium and phosphorus AL by Egner-Riehm method, and CaCO3 content was determined by Schäibler calcimeter. The following physical properties were analyzed: water content in the form of mass fraction in soil - gravimetric method (SRPS ISO 11465:2002) and mechanical composition of soil by pipette method with preparation of samples with sodium pyrophosphate and classification of texture classes according to ISSS. The results of soil fertility under plantations of Oblacinska cherry in Toplica district show that the examined soils are very acidic to weakly acidic reaction in H_2O and acidic to neutral reaction in 1M KCl, low to medium content of humus and total nitrogen and weakly carbonate in all analyzed plantations. The soils are optimally supplied with easily accessible potassium and low with easily accessible phosphorus. The water content in the form of mass fraction in the soil is used to translate the results of air-dry samples into the result expressed on the mass of dry soil. In the analyzed soils, clay loams, loams and light loams dominate by texture classes.

Key words: *Chemical and physical properties of soil, Toplica district, Oblacinska cherry*.

‘LEDA’ A NEW SOUR CHERRY CULTIVAR

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Abstract

Sour cherry is one of the most economically important temperate fruit species worldwide, which is widely used both fresh and processed. Due to the consumer demand for antioxidant-rich products, the development of new tart cherry selections with desirable quality characteristics is critical for the sustainability of cherry producers and processors. ‘Leda’ is a new sour cherry cultivar released from the sour cherry breeding program at the Institute PKB Agroekonomik. It was selected in mixed sour cherry orchard, from spontaneus seedlings population, and was recognized as cultivar in 2018 by the Serbian Ministry of Agriculture, Forestry and Water Management. The evaluation of this cultivar was done in comparison with the control cultivar ‘Oblačinska’ during a two-year period (2015 and 2017). Averagely, it bloomed a day or two after the control cultivar, while the ripening time was a day earlier than ‘Oblačinska’. The productivity is higher than the standard cultivar. The attractive bright red coloured fruits are larger (3.8 g), compared to ‘Oblačinska’ (3.3 g), with shorter fruit stalk length (2.9 and 3.4 cm, respectively). It has rich, mild flavour, sweet-acidic and harmonic taste, having slightly higher value of soluble solids/total acidity ratio (10.4) compared to the standard cultivar (9.5). ‘Leda’ is highly resistant to economically important diseases and pests (*Monilinia laxa*, *Monilinia fructigena*, *Blumeriella jaapii*, *Wilsonomyces carpophilus* and *Rhagolethis cerasi)*. This cultivar could be used both for processing and fresh consumption.

Keywords: *Prunus cerasus, new realised cultivar, light red colour.*

THE EFFECT OF ACTINOMYCETES APPLICATION ON GREEN MASS YIELD OF RED CLOVER

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Abstract

Red clover (*Trifolium pratense* L.) is one of the most important and widespread leguminous forage species in temperate agriculture, which is characterized by a high yield of quality biomass. Actinomycetes produce antibiotics and vitamins that act favourably on physiological processes in plants. These microorganisms are present in the soil, however the application of selected microorganisms for seed inoculation leads to better results in crop production. The experiment was carried out in vegetation pots in semi-controlled conditions. This research consisted of investigating the effect of actinomycetes (*Streptomyces* sp.) application on the green mass per plants of 12 cultivars of red clover of different geographical origin: K-27, K-32, K-38, K-39, Una, Kolubara, Viglana, Manuela, Wilo, Repio, Diana and Longevo. The effect of inoculation was determined out at the onset of flowering. The results obtained showed that the application of microorganisms could affect plant mass yield. The highest value for green mass per plant was achieved in cv. K-39 using inoculum that contained *Streptomyces* sp. The application of actinomycetes had a positive effect in the most cultivars of red clover and there was a statistically significant difference between inoculated treatments and control, indicating the justification of the use of these microorganisms in plant production.

Keywords: *Red clover, Cultivar, Actinomycetes. Green mass.*

ANALYSIS OF THE RELATIONSHIP OF THE MOST IMPORTANT TRAITS IN MEADOW FESCUE

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Abstract

Meadow fescue (*Festuca pratensis* Huds.) is one of the most important perennial grasses for animal feed production on grasslands. It is characterized by high and stabile yield potential and good biomass quality. The aim of this study was to determine genetic and phenotypic correlation coefficients of seven most important traits of two synthetic cultivars (Kruševački 21 and Pradel). Individual plants for hybridization, in order to obtain progeny by the method of Comstock and Robinson, were selected completely randomly. In order to examine the obtained progeny, the study was performed in an experimental field of the Institute for Forage Crops, in two replications. The experiment was set up according to the Nested Design I, with sets within the replications. In Kruševački 21, 60 full-sib progeny were studied in two sets, while in the Pradel a total of 39 full-sib progeny were studied. Within each full-sib progeny, 60 plants were analyzed. Statistically and high statistically relation was obtained between some traits and presented as genetic (r_g) and phenotypic (r_f) correlation coefficients. In cultivar K-21 very high statistically significant genetic correlation coefficients were determined between heading date and leaf length (r_g=0.873**), plant height and number of generative tillers per plant (r_g=0.893**) and dry matter yield in the first cut and annual dry matter yield (r_g=0.988**). In cultivar Pradel very high statistically significant relationship was obtained between heading date and plant height (r_g=0.978**), heading date and number of vegetative tillers per plant (r_g=0.926**) and annual dry matter yield with one side, and plant height (r_g=0.912**) and dry matter yield in the first cut (r_g=0.978**), on the other side.

Keywords: *meadow fescue, Nested Design I, genetic correlation coefficients, phenotypic correlation coefficients.*

EFFECTS OF IBA STIMULATORS ON PROPAGATION OF *LAVANDULA ANGUSTIFOLIA* MILL. BY SOFTWOOD CUTTINGS

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Abstract

Lavandula angustifolia Mill. is a perennial medicinal and aromatic plant belonging to *Lamiaceae* family. The lavender could be propagated either vegetatively or by seed. Vegetative propagation by cuttings is preferable since its seed is difficult to germinate and stocks of seeds are not always genetically homogeneous. Also, the yield of plants originated by seeds is lower than the yield of vegetatively propagated plants. The aim of this research was to determinate the optimal auxin concentration for rooting softwood cuttings of *L. angustifolia*. Cuttings were treated with the IBA based rooting powders "Chryzotop Green 0.25" (IBA 0,25%), "Rhizopon AA" (IBA 0.5%) and "Rhizopon AA" (IBA 1%) and only water (control) and put into trays filled with a mixture of peat moss and perlite for rooting. The experiment was performed in the laboratory conditions inside a polythene tent for plant propagation under artificial lighting and with the use of the intermittent mist-propagation system. After 30 days, the absolute root dry mass (mg) and the rooting rate (%) for 32 cuttings per treatment were recorded. The evaluation showed the efficacy of all IBA stimulators compared to control. The treatments with IBA 0.25%, IBA 0.5% and IBA 1% did not differ between themselves. Therefore, they could be successfully used as rooting stimulators of L. *angustifolia* as the absolute root dry masses were 5.32±1.82, 6.59±2.83 and 7.76±3.02 mg, while the rooting rates were 87.5, 90.6 and 87.5%, respectively. In control treatment, the absolute root dry mass was 2.46±0.77 mg, while the rooting rate was 68.8%.

Keywords: *lavender, vegetative propagation, cuttings, auxin*.

Acknowledgments: This study was supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia; Evidence number: 451-03-9/2021-14/200003.

THE EFFECT OF SODIC SOIL ABIOTIC STRESS CONDITIONS ON PHENOTYPE VARIATION OF SPIKE TRAITS IN HIGH YIELDING BREAD WHEAT

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Abstract

Bread wheat (*Triticum aestivum* L.) is important crop in temperate climatic regions, and one of the essential sources of energy for humans. Wheat is a crop of strategic value, because autochthonous production of food, based on own seed lay a solid foundation of freedom and independence. Climate changes that have led to increasingly stressful conditions in agriculture, posed new challenges for wheat breeders. A constant study of the phenotypic variation of the existing wheat varieties gene pool under stress conditions has become an integral part of contemporary wheat breeding programs. Four wheat varieties of the Institute of field and vegetable crops in Novi Sad, namely, Pobeda, Sara, Renesansa and Pesma were subjected to stressful conditions of solonetz soil. In normal production, the population plays the most important role in the formation of grain yield, but under stress conditions phenotypic variation of individual plants come to the fore. Phenotype variation of spike traits, grain yield components have been followed and studied in two environments. The principal difference of these environments was the type of soil - solonetz and chernozem. A variation in genotypes response to solonetz soil as a stressor growing environment has been denoted. The different variation of spike traits in study in variable environment was observed and quantified. According to the results there is still useful genetic variability that could be utilized in wheat breeding in order to obtain higher grain yield, and overall better economic performance on novel wheat varietal variation in abiotic stressful conditions of sodic soils.

Keywords: *Wheat, Solonetz, Stress, Spike, Variation.*

EFFECT OF DIFFERENT STRATIFICATION DURATIONS ON INCREASED GERMINATION OF *ALLIUM URSINUM* SEEDS

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Abstract

In this study, the optimal stratification duration of wild garlic (*Allium ursinum)* seeds was examined, in order to shorten the period of physiological dormancy. Collected, cleaned and dried seeds were subjected to the stratification method. Apart of the gathered seeds was placed in Petri dishes on dry filter paper, while the remaining fraction was placed in Petri dishes on wet filter paper. The previously mentioned seed placement had undergone treatments during the stratification period of 0, 4, 6, 8, 10, 12, 14, 16, 18, 20 weeks. Each treatment contained four repetitions of hundred seeds respectively. Seeds in Petri dishes on dry filter paper had a higher percentage of germination (52%) in contrast to others, placed in Petri dishes on wet filter paper (31%). During the stratification period of 12 weeks, the highest percentage of germinated seeds was attained, as well as the shortest length of the average germination time, along with the highest synchronicity.

Keywords: *Allium ursinum, germination, stratification, seeds.*

INFLUENCE OF GROWTH BIOREGULATORS ON SEED GERMINATION OF SOME MEDICINAL AND AROMATIC PLANTS

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Abstract

The research was conducted at the end of February 2021 in the Institute for Medicinal Plant Research "Dr Josif Pančić" in Belgrade, with the aim of analyzing the impact of growth bioregulators on the seed germination potential of some medicinal and aromatic plant species. Germination potential of Ocimum basilicum, Levisticum officinale, Calendula officinalis and Coriandrum sativum were analyzed following the ISTA guidelines. The seeds were treated with liquid growth bioregulators Ekobuster 1 and Slavol S for 10 minutes, while seeds in the control were treated with distilled water. Seeds of *Ocimum basilicum, Levisticum officinale, Calendula officinalis* and *Coriandrum sativum* treated with three different treatments: Ekobuster1, SlavolS and distilled water, were sown in three different containers. The seeds were sown in styrofoam containers with 160 cells with a mixture of peat moss substrate. The experiment was performed in the laboratory conditions. Containers were placed inside a polythene tent for plant propagation under artificial lighting and kept under air temperature of 23 ^{o}C with occasional wetting of the substrate. During the experiment, seedling emergence and development control as well as their pathogenicity control were performed every seven days. There was no occurrence pathogenicity on the examined plants.Based on the obtained results, germination of *Coriandrum sativum* seeds treated with Ecobuster 1 was 85%, while in seeds of *Ocimum basilicum, Levisticum officinale* and *Calendula officinalis* the highest germination was recorded with the use of Slavol S 82.5%, 90% and 82%, respectively; in relation to control treatment.

Keywords: *medicinal and aromatic plants, seed germination, growth bioregulators*

Acknowledgments: This study was supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia; Evidence number: 451-03-68/2021-14/ 200003.

DEVELOPMENT AND IMPLEMENTATION OF METHODS TO DETERMINE AN AGE STRUCTURE IN HARE POPULATION IN HUNTING GROUNDS OF SERBIA

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Abstract

A constant decrease in hare abundance in hunting grounds of Serbia is influenced by numerous abiotic and biotic factors among which anthropogenicones are particularly distinguished with an intensive agricultural production as their integral part. A rational utilization of hare populations and micro-populations is one of the most important methods to protect this species and it should be completely under the control of the users of hunting grounds. Therefore, it is essential to know precisely an age structure of hare population in certain terrain and to plan accordingly a degree of hare utilization in hunting grounds. Besides determining a spring hare abundance a determination of age structure of hare population in hunting ground should become obligatory by hunting grounds users. A procedure of collecting eye lenses from shot hares in order to determine a hare age has functioned successfully for more than four decades in hunting grounds in the region of Vojvodina. A problem of delivering eye ball samples is being present in hunting grounds in the region of Central Serbia. Whole heads and not eyeballs are being delivered for an analysis while delivery is being conducted two to three days after shooting so that a number of samples is considered unusable for analysis. The aim of this project is to find a solution for new protocol of handling hare frozen heads and eye balls what will substantially facilitate procedure of transporting samples and determining an age structure of hare populations in Serbia. A total of 306 eyeball samples taken from shot hares has been analyzed in six hunting grounds of Serbia. A standard procedure of determining the age of hares along with seven different procedures of defrosting the heads and taking eye lenses afterwardswith their fixation and drying according to a standard procedure has been applied. A statistically significant difference ($p < 0.05$) was determined between the masses of eye lenses of the same individual measured in standard procedure and in defrosting procedure.

Key words: *Lepus europaeus L, eye lense, age, new protocol***.**

THE INFLUENCE OF AGROECOLOGICAL CONDITIONS OF GROWING ON THE SMOKE SENSORY PROPERTIES OF BURLEY TOBACCO

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Abstract

Technological properties of tobacco that determine its usability are variable, so the quality of tobacco and tobacco products depends on the interaction of type and variety of genetic properties, on the one hand, and agroecological growing conditions on the other. The aim of this experiment was to determine the influence of agroecological conditions on the smoke sensory properties of Burley, as a large leaf tobacco type from experimental plots in five production areas in Serbia: Senta, Čoka, Šabac, Bajina Bašta and Vranje, during 2013. Hydrometeorological conditions data for vegetation period was taken from the Republic Hydrometeorological Institute of Serbia. The analysis of soil and basic chemical properties of first class middle leaves tobacco, after air curing and leaf processing, was performed using standardized methods. Cigarettes were made and the sensory characteristics of smoke (physiological strength, taste and aroma of tobacco smoke, fullness of smoking and cigarette combustion) were determined, using the key for sensory evaluation of quality according to Sozonović. The best sensory characteristics were determined in Burley from the production area of Šabac, and the worst from the area of Vranje, where oriental tobacco was previously grown. Growing conditions had an impact on the smoke sensory properties through the accumulation of chemical components in the tobacco leaf, since the same agrotechnical measures were performed in all five production areas. Agrotechnical measures that are adapted to the production area characteristics could reduce the impact of agroecological conditions to a minimum, which would enable the production of tobacco with better technological properties.

Key words: *burley tobacco, agroecological conditions, smoke sensory properties, chemical properties, soil properties.*

RESEARCH OF HUMUS REPRESENTATION IN AGRICULTURAL LAND

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Abstract

Humus is a stable form of organic matter in the soil, and at the same time it is most important form. Maintaining humus levels in the interval of 3-5% is the most important obligation of land users. However, the percentage of humus in soils has decreased in the last 20-30 years. Special emphasis should be placed on the harmfulness of burning crop residues on the plot for constant reduction of organic matter content and humus. As for the role of humus in the soil, its useful properties directly depend on which organic substances were the basis for it. In any case, it is a universal fertilizer suitable for different types of plants and soil. Moreover, it is permanently stored in the soil, it saturates it with useful elements. Humus and fertility - interconnected thing. In laboratory conditions, Agriculture Extension Service "Sombor" examined the humus content at two depths, of 0-30 cm and 30-60 cm, which consists of the oxidation of soil organic matter with 0.1N KMnO4 solution. The average humus content in this study on agricultural land in the layer of 0-30 cm was 3.18%, while the maximum content was determined at the site near the settlement of Telečka and amounted to 5.94%. The land where this humus content was recorded belongs to the type of meadow black carbonate on a light plateau. The lowest humus content was recorded on saline near the settlement of Stanišić. At a depth of 30-60 cm, the humus content in the soil is significantly lower and averages 2.28%, which is 27.3% less than the content in the layer of 0-30 cm. The highest humus content in the layer of 30-60 cm was also in the sample from point 102 in the area of Telečka and was 5.12%. The lowest humus content at the examined depth of 30-60 cm was in the sample from point no. 46 which is located in the cadastral municipality of Kolut and amounted to 0.13%.

Keywords: *humus, organic matter, oxidation, agricultural land.*

INFLUENCE OF DIFFERENT DENSITIES DURING SOWING ON BUCKWHEAT (*FAGOPIRUM ESCULENTUM* L.) YIELD AS A SUBSEQUENT IN AGRICULTURE

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Abstract

Buckwheat is a very old culture native to Asia. It does not show great demand for the soil, it can be grown on slightly acidic soil (up to pH 5.5), but it requires a more humid climate (with more precipitation) because it is quite sensitive to drought and high temperatures, especially during flowering and pouring grain. Sowing is done when the soil is heated to about 15 °C. Sowing can start from 01.05. to 15.05. when there is no danger of frost. The density of the assembly is about 200-250 germinating seeds per m^2. An experiment with 12 different buckwheat populations was set up on the PSS "Sombor" experimental field. Three experiments were set up with the same row spacing of 25 cm, while the row spacing on the first variant was 5.0 cm, on the second 3.75 cm and on the third variant 2.5 cm. During the experiment, the condition of the crops was monitored, as well as the yields after the harvest, which clearly showed that when using buckwheat as a side crop, we had to go for a denser sowing (2.5 cm). Due to relatively low yields (about 2 t/ha), the production of buckwheat as the main crop in Vojvodina is less profitable. Buckwheat is a very competitive plant with weeds due to its rapid germination and strong initial growth, so it quickly over shadows the surface, and thusthus sprouted weeds. That is why it is good to sow it as a functional food, and if necessary for green manure.

Keywords: *sowing, buckwheat, agriculture, subsequent, sowing densit.*

GENERAL COMBINING ABILITY AND HETEROSIS OF SEX EXPRESSION TRAITS IN MELON

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Abstract

Melon is an annual, cross-pollinated species belonging to the family of *Cucurbitaceae*. Melon plants are usually monoecious: male and female flowers develop on one plant, but most commercial varieties and hybrids are andromonoecious, and on their plants develop male and hermaphrodite flowers. On melon plants, male flowers appear first, and then develop flowers with female reproductive organs. In this experiment, eight melon genotypes (parents), of which four were monoecious (Sesame, ED-3, ED-4, Pobeditel), and four andromonoecious (Chinese muskmelon, Anannas, Honey dew, A2-3lb), and their 20 hybrids (monoecious) were used. The experiment was conducted in Smederevska Palanka, during two vegetative seasons. Seven characteristics related to sex expression were observed. The aim was to determine the parents with the best general combining abilities (GCA) and to determine the heterosis in their hybrids for all seven observed traits. Negative heterosis for the trait period from sowing to the emergence of the first perfect/pistillate flower was recorded in 16 of 20 genotypes. A reduction of the period between the appearance of male (positive heterosis) and perfect/pistillate flowers on plants (negative heterosis) was found in 12 hybrid combinations. It was found that in as many as 17 hybrid combinations, the fruits ripen earlier than their parents. All eight observed parental genotypes showed significant GCA values for most of the observed traits. The results showed that the Sesame was the best general combiner, and represented a potential source of the desired alleles required for the melon breeding programs.

Keywords: *Cucumis melo L.*, *monoecious*, *andromonoecious*, *hybrid*, *flowering.*

SATUREJA MONTANA L. CULTIVATION UNDER PERMEABLE MULCH FILM IN DRY FARMING CONDITIONS OF SOUTH BANAT (SERBIA)

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Abstract

Satureja montana (winter or mountain savory) is a perennial, medicinal plant native to temperate regions. Most studies on winter savory are primarily focused on the secondary metabolites, but a small number of researches are related to agronomic practices and proper growing conditions. Five years investigation was conducted in dry farming conditions of South Banat, Serbia, on chernozem soil, with the use of a black permeable mulch cover. Yield response to different models of fertilization (organic and mineral), and two crop densities on yields (per plant and per m^2) were observed. Average plants density decreased every year, on 95.4%, 87.0%, 83.3%, 64.6% and 48.6% of the initial densities, respectively. The density during the 4th and 5th year decreased faster in organic model of fertilization compared with mineral one, where initial planting density had no impact. Herb yield (Satureja herba) increased in an average of 306.7, 779.1, 981.3 gm^{-2}, in the first three years, and then decreased to 559.9 and 404.7 gm^{-2} in the 4th and 5th years of cultivation. Yield per plant increased in the first three years of cultivation, averaging 79, 184.4, 283.5 g per plant, while in the 4th and 5th it decreased to 209.6 and 203.4 g per plant, respectively. Yield per plant was higher at lower initial density (3.6 pl m^2) compared to the higher one (5 pl m^2), except in the first year. The fertilization model did not affect the yield per plant, during most of the experimental period.

Keywords: *Winter savory cultivation, Mulch film, Fertilization, Crop density, Yield.*

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GENETIC RESOURCES OF SERBIAN NATIVE HERBACEOUS PEONIES

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Abstract

Although the plants are essential in human life, their overuse, habitat, and climate changes lead to an increase in the number of threatened or endangered plant species. The family *Paeoniaceae* includes only genus *Paeonia*, with about 35 species native in the northern hemisphere. The genus possesses great ornamental, edible, and significant medicinal value. Even though peony has the longest history out of all flowering peonies, and its genus characterizes longevity, disease, and pest resistance, in many cases their quite delicate wild relatives are becoming rare, or endangered at their native habitats. Five herbaceous peony species are native and protected in Serbia: *Paeonia officinalis* (*European or common peony*), *Paeonia peregrine (Kosovo's peony*), *Paeonia tenuifolia* (*Steppe peony*), *Paeonia mascula (Balkan, wild or male peony)* and *Paeonia banatica* (*Pannonian peony).* The last-mentione done is considered endemic, relict species, and it is strictly protected in Serbia. So far, research on Serbian wild peonies has been mainly oriented to their distribution, quantification, and habitat conservation. Also, literature data related to their morphology are scarce. However, there is no scientific data related to their seed and root dormancy, germination, soil or nutrients requirements, tolerance to drought or resistance to diseases, all of them being crucial factors for the plants growth and development. Therefore, the main goal of this review is to present up to date research related to the possibility to establish *in situ* and *ex-situ* collections as important steps towards the protection of genetic resources of Serbian peonies and their possible introduction into culture.

Keywords: *Paeonia officinalis, Paeonia peregrine, Paeonia tenuifolia, Paeonia mascula, Paeonia banatica.*

Acknowledgments: The research in this paper is part of a project 451-03-9/2021-14/200003 funded by the Ministry of Education, Science and Technological Development of the Republic of Serbia

THE IMPACT OF INTEGRATED GROWING SYSTEM AND TOP DRESSING IN PRODUCTIVITY OF WINTER WHEAT

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Abstract

The examination of the effects of sustainable growing systems on the grain yield of winter wheat was conducted at the research and study field "Radmilovac" of Faculty of Agriculture (44°45' N, 20°35' E Serbia, 130 m above mean see level). Investigations was conducted in 2016/17 and 2017/18 on the luvic chernozem soil type, in completely randomized blocks. In intergrated growing system (IGS), based on low inputs, tillage was performed using a chisel plough at 25 cm with ≥30% of maize crop residues retaining on the soil surface and the pre-sowing tillage using a disc harrow and a harrow, basic fertilization in autumn with 600 kg ha^{-1} NPK and top dressing in spring with 60, 120 kg ha^{-1} N and control treatment, without top dressing. Two common winter wheat cultivars (*Triticum aestivum* ssp. *vulgare*) Ilina and Zvezdana grew in this growing system. Statistical analysis confirmed that year, variety and top dressing had a significantly greater impact on grain yield and year and top dressing on weight of 1000 grains. Interaction of year*cultivar and year*top dressing had a significant effect on investigation parameters. More favorable meteorological conditions in the first year led to obtaining statistically significantly higher grain yields (5885.56:5585.56 kg ha^{-1}). A higher yield per unit area was found in the Ilina variety (6012.22 kg ha^{-1}) compared to the Zvezdana variety (5458.89 kg ha^{-1}). With increasing N dose in top dressing, the weight of 1000 grains and the grain yield of winter wheat increased in both tested varieties (5437.5; 5704.17; 6065.00 kg ha^{-1}). An integrated cultivation system on heavier soils has less positive effects than on soils with more favorable characteristics, especially in the higher dose of N.

Key words: *integrated management, winter wheat, grain yield, top dressing.*

INFLUENCE OF VINEYARD GRASS COVER ON TECHNOLOGICAL CHARACTERISTICS OF WINE GRAPE CULTIVARS

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Abstract

Research was performed in vineyard of "Radovanović" winery, Serbia. Experimental vineyard is located at altitude of 220 meters, GPS coordinates N 44º 25' 47"and E 21º 02' 14". Row spacing is 2.4 m and 0.9 m between vines in row. The inter-row space was sown with a following grass-legume mixture: 60% *Festuca rubra*, 30% *Lolium perenne* and 10% *Trifolium repens*. Experiment with grass-legume mixture was set with two factors, fertilization with two nitrogen fertilizers (AN and KAN) and rates of 0, 50 and 100 kg N ha^{-1}. The yield of fresh and dry biomass and visual assessment of grass quality under influence of nitrogen fertilization were monitored. For soil fertility analysis samples were collected from 3 depths: 0-30, 30-60 and 80-100 cm. The most important grapes and berries structural indicators, sugar and total acids content in must were determined. The aim of the research is to determine influence of grass inter-row cover maintained according to criteria of optimal turf management, on structural indicators and quality of grapes. Results show that soil pH generally increases with depth, concentrations of organic C, total N and available P_2O_5 and K_2O decrease with depth. Grass groundcover and fertilization have a clear influence on examined soil fertility parameters. Sugar content in must varied from 17.6–25.2%. Large variations were found for bunch weight (103-259 g), epicarp weight from 100 berries (2.23-9.62 g) and average seeds number from 100 berries (110-177).

Keywords: *wine grape, soil, grass cover, structural indicators, grape quality.*

SOIL ORGANIC MATTER AND SOIL STRUCTURE IN LONG-TERM FERTILIZED SANDY SOIL

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Abstract

The mineral fertilizers and organic manures are considered to be a significant intensifying factor, which apart from the higher yields can also improve the fertility, predominantly of sandy soils. This was the reason for carrying out three long-term experiments of SGGW at the sandy soil in Skierniewice (Poland). Soil structure parameters and soil organic matter (SOM) after the application of fertilizers were monitored. Treatments of experiments: Co – Control without fertilizers, NPK – NPK fertilizers, CaNPK – CaNPK fertilizers in 41- and 94-years-long experiments, and FYM (farmyard manure) as control, FYM+NPK and FYM+CaNPK in 25-years-long experiment. In the 94-year-old experiment with mineral fertilization, the content of SOC in Co, NPK and CaNPK was 0.41, 0.59 and 0.60 %, respectively. The same tendencies were in the 25-year-old experiment with mineral fertilization + FYM, whereSOC increased by 38% and 26% in FYM+NPK and FYM+CaNPK, respectively, compared to control. Contents of humic substances significantly increased due to fertilization in the 25 and 42-year-old experiments. In all fertilized treatments, the humus quality significantly decreased. After 94 years of mineral fertilization, the content of water-stable macro-aggregates (WSA_{ma}) in size fractions >5 and 5-2 mm were significantly higher in NPK than Co and CaNPK treatments. Application of FYM with CaNPK significantly reduced aggregate stability in 25-year-old experiment. The aggregate stability significantly decreased due to application of NPK alone after 42-year mineral fertilization. Overall, in all fertilized treatments, the SOC significantly increased, but fertilization had different effects on structure in the sandy soil.

Keywords: *Aggregate stability, Fertilization, Soil organic carbon, Sandy soil.*

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RESPONSE OF BARLEY (*HORDEUM VULGARE* L.) TO FOLIAR APPLICATION OF SILICON

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Abstract

Silicon is an abundant element in the earth's crust. It is not an essential element for most plants, but some plants accumulate more silicon than others. One of the silicon accumulators is barley (*Hordeum vulgare* L.), an agriculturally important species. In experiment that lasted 35 days, barley was grown on a floating hydroponics system. Plants were stabilized in pots that contained rockwool, which served as one source of silicon. Half of the plants were additionally sprayed with potassium silicate (0.25 ml 6% K_2SiO_3 L^{-1}) every ten days. The vitality of plants during their growth was monitored by measuring the potential photochemical efficiency of photosystem II. After 16 and 35 days of silicon application, shoot length, root length, fresh and dry biomass were measured. After 35 days, the number of leaves and shoots, specific leaf area, leaf optical properties, and lipid peroxidation were determined. Potential photochemical efficiency of photosystem II was unaffected by silicon, indicating that plants were not in stress. Results showed lower leaf reflectance for silicon-treated plants in UVA, UVB, and blue light wave lengths. It may be caused by a layer of potassium silicate on leaves. Statistically significant differences were also found on the 16^{th} day after silicon application when roots were shorter in control plants, compared to treated plants, and the fresh shoot weight of silicon treated plants was higher than in control plants. There were no differences in other analyzed characteristics. We confirm that additional foliar application of silicon does not cause stress in the barley plant.

Keywords: *potassium silicate, barley, Hordeum vulgare, hydroponics, foliar application.*

EVALUATION OF PRESPRAUTING AND DIRECT COVERING TO ENHANCE EARLY TUBER YIELD OF POTATO CROPS (*SOLANUM TUBEROSUM* L.)

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Abstract

Several factors can influence yield and nutritional quality of vegetable crops. The resaearch focused on early potato (*Solanum tuberosum* L.) production in Gorenjska region, Slovenia. A field study was conducted during 2020 growing season, at the Experimental field of the Biotechnical Centre Naklo (an altitude: 420 m; φ = 46° 16′ 18″; λ = 14° 18′ 56″). The soil of the experimental plot was gravel clay with pH 6.7. The experimental layout was a split-split-plot design with four replications. Cultivar was the main plot ('Arrow', 'Esme' and 'Adora'), agro-textile covering (polypropilene covered and uncovered) the subplot and presprauting (presprouted and not presprouted tubers) the sup-subplot. The potatoe seeds of a size 28 to 35 mm were sprouting over a four weeks period, then planted mechanically within the rows of 30 and 75 cm between the rows. Planting date was 1 April and tubers were harvested at optimum maturity, 76 days after emergence. The crops were managed according good farming practices. The presproued and covered treatments speed up the emerge of the potato tubers for 2.1 to 3.8 days depending on the cultivar. Compared to the controls, covering increased number of above ground stems per crop and the stems height. In total, all of the cultivars, covered crops produced a greater number of tubers than reference uncovered treatments (143500 to 254600 tubers/ha comparing to 94800 to 175600 tubers/ha, respectively). Alike, for all cultivars, presprouting tubers increase number of tubers per unit area. The faster development of presprouted and covered crops resulted in higher yield, both as total and yield in the fraction >70 mm. Total yield of marketable-size tubers are higher (18 to 24 t/ha) when using polypropylene covers in comparison to non covered crops (11 to 16 t/ha). The presprouting and covering treatments significant influenced on dry matter in tubers. On the other hand, treatments had no influence on ascorbic acid in tubers.

Key words: *yield, potato, Slovenia.*

ANALYSIS OF THE CLIMATOLOGICAL VARIABLES AND THE INDEX NDVI IN THE CULTIVATION OF THE OLIVE TREE IN EXTREMADURA (SPAIN)

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Abstract

The present study has been carried out in the olive region of Extremadura (261.349 ha) which has the highest concentration of vineyards in the southwest Iberian Peninsula in the area of Tierra de Barros with approximately 56,700 ha of olive grove. Most of the cultivated area is managed in rainfed conditions, being very affected by changing climatic variables, such as temperature and precipitation, with great influence on olive oil production and quality, causing a high variability between years. Remote sensing has allowed satellite monitoring of crops. Among the tools available for the satellite, crop indices have shown the most interest in recent years. The normalized difference vegetation index (NDVI) has been proposed as an indicator of the adaptation of crops to climatic conditions, expressing the vigor of them and therefore is an integrator of the effects of climate on crops. Through the measurements of NDVI (2000-2018) of olive tree in a traditional dry farming area in Extremadura, the evolution of the index and its relationship with climatic variables was analyzed. To determine monotonic trend, the Mann-Kendal test was used and to obtain correlation between variables the Pearson test was used. The results indicated that the NDVI showed variability according to the development period of the olive tree and the period studied, indicating increasing values. The value of the index was related to rainfall as well as temperatures. So this index is a good indicator to detect the state of the vineyard in the climate change scenario.

Keywords: *Olive tree, climatic variables, NDVI, Extremadura, Spain.*

TRENDS IN EVAPOTRANSPIRATION IN THE SOUTHWEST OF THE IBERIAN PENINSULA, IN THE CONTEXT OF GLOBAL WARMING

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Abstract

The Southwest of the Iberian Peninsula (IP), due to its geographical position, is an area highly affected by climate change. Numerous studies have highlighted the increase in annual temperatures as well as a decrease in rainfall. Both variables considerably affect the performance of crops and livestock, being the primary sector very important for the economy of the area. This study analyzes the evolution (1960-2019) of annual and seasonal Evapotranspiration (ETP, water needs of crops) of the Southwest of IP. Daily data from eight selected weather stations belonging to the European Climate Assessment & Dataset were used. In addition, the evolution of the FAO index (P/ETP) that determines what part of the evapotranspiration is covered by precipitation (P), is analyzed. To determine the monotonic trend, the Mann-Kendal test and Sen's slope estimator were used. The results show a significant positive trend of the annual ETP throughout the study area. This trend was found in all seasons except fall and especially spring and summer. The FAO Index, showed a smoother general reduction, but with differences between the seasons. Summer was the most affected season by this reduction. All this indicates that the water needs of the crops are increasing, and that the contribution of rain is decreasing, especially in the most demanding seasons (spring and summer), so that irrigation resources will increase progressively. It is necessary to introduce species more tolerant to drought, the application of deficit irrigation strategies and the implementation of new and more efficient irrigation technologies.

Key words: *global warming, Iberian Peninsula.*

GENOTYPING OF SOME SELF-(IN) COMPATIBILITY SI/SC RESPONSIBLE GENES (S_X, S_F-RNASE) IN SOME ALMOND CULTIVARS

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Abstract

The current investigation was carried out in Sweida governorate-Syria(2019-2020) on 14 almond cultivars (5 local cultivars Auja, Dafadei', Doma 12, Shami Farek, and Fostouki, and 9 introduced ones Ni Plus Altra, Desmayo Largueta, Cristomorto, Mission/Texas, Fluetes, Papines, Fournat de Brezenaud, Princesse and Ferraduel). Most almond cultivars exhibit self-(in) compatibility (SC/SI) behavior, and some of them are cross-incompatible. Therefore, this research aimed to identify almond cultivars through their hereditary behavior by determining the S-RNase sites using seven conserved and specific primer pairs to detect the target loci (S_f, S_x-RNase). Six primer pairs were affective to amplify the target alleles (S^b/S_1 1072bp, S_3: 611, 790, 1200bp, S_6 860bp and S_{25} 600bp). The identified cultivars were: Cristomorto (S_1 S_6), Desmayo Largueta (S_1 S_{25}), Princesse (S_1 S_3) and the local cultivar Dafadei' (S_1 S_6 S_3). Furthermore, new S-alleles sites of S-RNase were genotyped in different cultivars such as Flutes (S_3 $S_{?470}$), Ni Plus Altra (S_3 $S_?$440), and Doma 12 (S_3 $S_{?485}$). The present study also identified the active/inactive S_f-RNase (S_{fa}/ S_{fi} R-Nase) according to their apparently and hereditary behavior which recognized the cultivars as SC S_{fi} (Cristomorto, Fostouki, Princesse, and mission/Texas), while the gene SI S_{fa} existed in all other SI cultivars. Our results confirmed the importance of identifying the S-allele gene structure in the style tissues due to their highly significance when establishing new breeding programs. Moreover, the results recommended using the combinations of ConF/ConR, AS1II/AmyC5R1, Primer 6/7, S3F/S3Rand (SfF/SfR) for detecting S_f-RNase genes in almond cultivars.

Keywords: *S-allele locus, target gene, self- incompatibility, almond, S-genotypes.*

IMPACT OF PRUNING LEVEL ON THE PRODUCTIVITY AND QUALITY PARAMETERS OFCARIGNAN WINE GRAPE CULTIVAR UNDER AS-SWEIDA GOVERNORATE CONDITIONS

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Abstract

This research was carried out in the fields and laboratories of Apple and grapevine Research Department in Sweida Governorate- Syria during the period 2016-2018 on 20 years old Carignan wine grape cultivar grafted on Paulsen 1103 rootstock, in order to study the impact of the pruning level on productivity, and quantitative and qualitative characters of bunches and berries. The vines were pruned with three levels 4, 6 and 8 nodes/cane, with a total of 48 fruitful buds/vine. The results showed that the highest average of fertility rate was at 8 nodes/cane (76%). Productivity varied by the applied Pruning treatments as the pruning treatment 4 buds/cane significantly revealed the highest production (15 Kg/vine). Concerning the average of bunch weight, there were no significant variance among all pruning levels, and the highest bunch average weight wasin 8 buds/cane treatment (163g), which also significantly revealed the highest weight of 100 berries (195.6 g), as well as the average ratio of juice (66.2 ml/100g). However, the effect of pruning levels varied in the average of total soluble solids (TSS), total sugar (TS), and titratable acidity (TA). Consequently, the results indicate the effective role of determining the level of pruning in Carignan wine grape cultivar and its impact on fertility, production characteristics and quality characters of this wine grape cultivar.

Keywords: *Grape, pruning, wine cultivar, fertility, productivity*.

FRUITING PATTERNS OF SOME STRAWBERRY CULTIVARS IN OPEN FIELD AND GREENHOUSE CONDITIONS

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Abstract

For the last few decades, the most crucial goal in strawberry cultivation has been to extend the harvest season. Day-neutral varieties are increasingly being used to extend the season. The study aimed to determine the fruiting patterns of some day-neutral and short-day strawberry cultivars grown in open field (OF) and greenhouse conditions (GH). Frigo plants of some day-neutral ('Monterey', 'Albion', 'Sweet Ann', 'San Andreas') and short-day ('Benicia', 'Fortuna', 'Rubygem', 'Festival', 'Camarosa', 'Amiga') strawberry cultivars were planted on 7-8th July 2014 on raised beds covered with silver-grey polyethylene mulch in plastic greenhouse and open field in Samsun, Black Sea Region, Turkey. In OF condition, harvest commenced in May and terminated in October. Day-neutral (DN) cultivars extended the harvest season up to October, two months longer than short-day cultivars. On the contrary to GH, there was no harvest of any variety in April in OF. In OF conditions, intensive harvest periods were May and June for all cultivars. In OF, all cultivars continued fruiting in July and August, but yield of day-neutral cultivars were higher; however, yield of short-day (SD) cultivars 'Fortuna', 'Rubygem' and 'Festival' were also remarkable. Generally, yields were not obtained from short-day cultivars in September in OF. In GH conditions, harvest commenced in April and continued until September with day-neutral and some short day cultivars 'Festival', 'Fortuna' and 'Rubygem' with insufficient yields, none of the cultivars had fruit in October. In GH, the intensive harvest period was May for almost all cultivars. However, Aril was intensive harvest time for 'Benicia', June for 'Festival' and 'Rubygem', April and June for 'Fortuna'. In general, there were no apparent differences between short-day and day-neutral varieties in terms of fruiting patterns in GH, however in June and July, it was noted that short-day cultivars had higher yield than day-neutral. Yield decreased gradually from the beginning of July to the end of August in all cultivars in GH.

Keywords: *Strawberry, Cultivar, Greenhouse, Open Field, Harvest Period, Yield.*

THE EFFECT OF CLIMATE CHANGE AND THE INFORMATION SOURCES USED IN THE ENTERPRISES PRODUCING SUNFLOWERSEED

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Abstract

Sunflower, a member of the Asteraceae family; It is one of the world's strategic products. In the world, oilseed production is of great importance due to the economic value it creates. For this reason, it is very important for countries that the seed sunflower is affected by climate change. The increasing impact of climate change on agricultural production has a wealth of literature focusing on the potential value of weather and climate information to help farmers prepare and respond to these impacts. However, while the impact of climate change on the agricultural sector is growing, there is no clear de facto practice to reduce this impact. In this study, the effect of climate change and the information sources used on climate change in the enterprises producing Sunflower seed were examined. The sample volume was calculated as 62 with a 99% Confidence Interval and 10% error margin for the stratified sampling method, which was one of the simple random sampling methods. The effect of climate change on sunflower production was investigated. As a climate change effect, 1st group enterprises showed drought (4.54), 2nd group enterprises showed insufficient precipitation (441) and 3rd group enterprises showed drought (4.65). The information source used on climate change is the internet (4.36). The internet, agricultural engineers, pesticide dealers, leading farmers, visual and written media should be used to raise awareness about climate change for businesses producing seed sunflowers.

Keywords: *Sunflower, Climate Change, İnformation Sources.*

AGRO-MORPHOLOGICAL CHARACTERIZATION OF SIX-ROW BARLEY (*HORDEUM VULGARE CONVAR. HEXASTICHON* L.) LANDRACES

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Abstract

Barley (*Hordeum vulgare* L.) is an important crop for the world. Narrowed and uniformed barley gene pools are inadequate for new cultivar development studies. One of the primary gene sources to develop superior varieties with greater adaptation ability is the landraces. In the present study, a total of 472 six-row barley genotypes preserved in Osman Tosun Gene Bank at the Department of Field Crops Faculty of Agriculture Ankara University, and one check cultivar were used. To prevent heterogeneity in the landraces, each threshed spike belonging to each genotype was sown in an Augmented design in a single row of one m length with a spacing of 40 cm between the rows in 2019 growing season. Data were recorded for 11 agronomic traits; days to 50% flowering (DFL), plant height (PH), flag leaf area (FLA), spike length (SL), row number of spikelets (RNS), number of grains per spike (NGS), grain weight per spike (SGW), weight of main stem (SPW), thousand grain weight (TGW), number of tillers (NT) and harvest index (HI). The genotypes evaluated in this study showed wide range of variation in terms of investigated agro-morphological traits. The variation studied with principal component analysis showed that two principal components having greater than one eigen values contributed 53.57% of the total variance among 11 variable agronomic traits. Moreover, among early-flowering genotypes, seven genotypes showing superior agronomic traits related to the yield were identified to gene resource to use six-row barley breeding studies. This study is supported by TUBITAK with grant number 119O092.

Keywords: *Landrace barley, Agro-morphological traits, Genetic diversity, Early flowering, Hordeum vulgare.*

ROLE OF DIFFERENT PHOSPHORUS LEVELS ON THE SEED YIELD AND SOME YIELD COMPONENTS OF CLUSTER BEAN (*Cyamopsis tetragonoloba* (L.) Taub.)

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Abstract

Phosphorus (P) is responsible for a number of functions which its major importance to physiological and biochemical function of plant in sustainable agriculture system. However to maximize metabolic functions, legumes need more phosphorus as it is required for energy transformation in nodules. Therefore, an experiment was conducted to understand the yield and phosphorus demand of cluster bean. This trial was arranged as a completely randomized block design with four replications from March to July of 2020 in the outdoor conditions at Izmir, Turkey. An application of phosphorus influences symbiotic nitrogen fixation yield and quality of cluster pods. For this reason, a pot experiment was carried out to investigate the effect of phosphorus levels (0, 60, 90, 120 and 150 kg P ha^{-1}) on the seed yield and some yield components of cluster bean (Pusa Nevbahar cv.). Results shown that rate of phosphorus has a significant effect on plant height, number of pod, biomass weight, seed yield and thousand grain weight of cluster bean. Application of phosphorus at the rate of 120 kg ha^{-1} can be recommended for obtaining the maximum seed yield in cluster bean under Mediterranean climate conditions.

Keywords: *Cluster bean, P level, seed yield.*

GRAIN YIELD AND SOME AGRONOMICAL CHARACTERISTICS OF TEFF [*Eragrostis teff* (Zucc.) Trotter] AS AFFECTED BY SOWING DATES

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Abstract

The sowing date defines the environmental conditions to which the crop will be exposed in important key moments of its developmental cycle that critical period for yield and quality components. Early or late planting dates on crop causes an array of morphological, physiological and biochemical changes which affect growth and development and such changes may lead to a drastic reduction in yield. This research was carried out to determine the potential of teff as a staple crop for the Mediterranean climate during 2015 and 2016 in Soke-Aydin (Turkey). The main goal of the study was to establish the optimal teff planting date for the highest grain production. The effects of different sowing dates on the grain yield and some yield characteristics were investigated. Four different dates of sowing (15th April, 15th May, 15th June and 15th July) were arranged in a Randomized Complete Block Design with three replications. The teff genotype "Dessie" was used as plant material and number of plants, plant height, panicle length, thousand-grain weight, biological yield and grain yield were tested. Two-year average results indicated that there were significant differences in mentioned characteristics among the sowing dates. The experiment has shown that the influence of sowing date on grain yield is mainly due to day-length and temperature differences that are associated with delaying the planting from April to July. Delayed sowing dates reduced the grain yield. The highest total grain yield, 2780 kg ha^{-1}, was obtained for the teff seeds sown on the 15th April under Mediterranean ecological conditions.

Key words: *Grain yield, Mediterranean climate, sowing date, teff.*

GROWTH AND DEVELOPMENT OF 'ALBION', 'PORTOLA' AND 'SWEET ANN' DAY-NEUTRAL STRAWBERRY VARIETIES IN SUMMER AND FALL CROP PRODUCTION

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Abstract

Common cultivation of day neutral strawberries in Turkey is relatively new. In Black Sea Region in North of Turkey where prevails the cool temperature in summer, there is an increasing interest in the cultivation of day-neutral strawberries. Also producers are just getting acquainted with summer production with day-neutral varieties. This study was aimed to provide a detailed characterization of seasonal growth, development, yield and fruitquality in summer and fall crop production of day-neutral varieties 'Sweet Ann', 'Albion' and 'Portola'. Growth, development, yield and fruit quality showed considerable differences among varieties. 'Albion' showed the lowest and 'Sweet Ann' the highest values for the vegetative parameters such as leaf area, leaf number, runner and crown number, leaf, crown and root dry weight, total plant dry weight. 'Portola' showed similarity to 'Sweet Ann' in terms of this vegetative growth parameter. First flowering started on 6 May in 'Albion' and 'Portola'; 15 May in 'Sweet Ann'. First harvest started 10 June for 'Portola' and 'Albion', it started 15 June for 'Sweet Ann'. Last harvest was 29 November for all varieties. Flowering of all varieties intensified in July, August, September and October, and the peak flowering was in October in all varieties due to the ideal weather conditions in October. Flower number was the lowest in 'Albion', it was the highest in 'Sweet Ann' following 'Portola'. As a result, yield was also the lowest in 'Albion', the highest in 'Sweet Ann' following 'Portola'. Total Soluble Solids (TSS) was the highest in 'Albion' following 'Portola', while it was the lowest in 'Sweet Ann'.

Keywords: *Day-neutral strawberry, Summer crop production, Growing, Development, Seasonal variation.*

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EVALUATION OF TURKEY STONE FRUIT SAPLING PRODUCTION

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Abstract

The aim of this study is to evaluate the developments in sapling production belonging to stone fruit group in Turkey. Turkey is among the most important countries in the world in terms of growing stone fruits. Turkey ranks first in apricot and cherry production in the world. According to the records of the Ministry of Agriculture and Forestry, the total sapling production of all fruit species in Turkey in the last 10 years has been 821,204,752. The production amount of plant material belonging to the species in the stone fruit group was 153,244,169 (18.66%). In this period in Turkey (2010-2020), within the sapling production amount of stone fruits, Peach production (54.537.394) rate was 35.58%, Sweet Cherry production (44.821.031) rate 29.25%, Plum production(25.962.317) rate 16.94% Apricot production (19.976.620) rate, 13.03%, and nectar sapling production rate was 5.19%. Turkey is in a very important position in the world in the production of stone fruit saplings. Turkey exports stone fruit seedlings. It has been determined that there has been a significant increase in sapling production and orchard facilities of stone fruit species over the last 10 years. These increases in fruit sapling production and orchard facility have been obtained through an important contribution of the grant support given by the state.

Key words: *Stone fruit, sapling, proouction, Turkey.*

THE DEVELOPMENT OF *CONVOLVULUS ARVENSIS* COLLECTED FROM DIFFERENT PROVINCES UNDER DIFFERENT TEMPERATURE AND CO_2 CONDITIONS

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Abstract

Convolvulus arvensis is one of the worst weeds worldwide. This Euroasian plant is a detrimental problem in agricultural areas of Turkey as well. Climate change, with increasing temperature and greenhouses rates and unpredictable extreme weather events, has been among foremost problems of world. Its effects on weeds and crops are getting importance due to predicted future changes and ask for takeing measures to mitigate negative effects of climate change. The effect of rising temperature and CO_2 on different populations on *C. arvensis* was studied under greenhouse conditions in the Malatya Province of Turkey in 2018 and 2019. Two temperature regimes (day/ night 16/26 °C and 19/29 °C) and two CO_2 levels (400 and 800 ppm) were used. *C. arvensis* populations were collected from 14 different provinces representing different climate and altitudes: Adana, Ankara, Istanbul, Izmir, Erzurum, Hatay, Karaman, Kayseri, Konya, Malatya, Samsun, Şanlıurfa, Tekirdağ and Usak. Measurements were done two months after experiment setup. The length of vegetative parts of *C. arvensis* plants did not differ among populations under all four conditions while dry weight was significantly affected by populations under 800 ppm CO_2 in 26^0C and 400 ppm in 29^0C. Rising CO_2 mainly did not affect the length or dry weight under any temperatures for populations. It is concluded that populations from different areas show similar respond to CO_2 rates and temperatures, which reveals why *C. arvensis* is among the worst weed worldwide, i.e. its adaptation power in different environments is clear.

Keywords: *Convolvulus arvensis, temperature, carbon dioxide.*

THE EFFECTS OF THE ESSENTIAL OIL OF PENNYROYAL (*MENTHA PULEGIUM* L.) ON THE GERMINATION OF SOME WEED AND CROPSEEDS

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Abstract

Penny royal (*Mentha pulegium* L.), which is among the medicinal and aromatic plants belonging to the Lamiaceae family, is a plant rich in essential oil. Due to its essential oil properties, this study was conducted in Malatya Turgut Ozal University, Faculty of Agriculture, Department of Plant Protection, Herbology Laboratory in 2020 in order to determine its effect on the germination of weed and cultivated seeds. In the study, the bio-herbicidal effect of different doses (0.5, 1.0, 2.0, 4.0, 8.0 and 16.0 µl/petri) of the obtained essential oil on the germination of two cultivated plants [(*Capsicum annuum* L.) and ((*Triticum aestivum* L.)] and four weed [(*Amaranthus palmeri* S. Wats.), (*Amaranthus albus* L.), (*Avena fatua* L.) and (*Sinapis arvensis* L.)] seeds was investigated. At the end of the study, it was observed that as the amount of used doses increased, the germination of seeds was suppressed more and the highest effect (100%) was determined in 16 µl/petri dose application on all seeds. The lowest effect (1%) was obtained from the application of 1 µl/petri dose of *S. arvensis* seed. In terms of LD_{50} and LD_{90} values in the study, the highest dose was seen in *T. aestivum* as 3,520 and 7,857 µl/petri and the lowest dose was seen in *A. palmeri* seed as 0,004 and 0,175 µl/petri. As a result, it was concluded that the essential oil obtained showed this effect in lower doses in weeds, while a higher dose was needed to prevent the germination of cultivated seeds.

Keywords: *Mentha pulegium, essential oil, weed.*

DETERMINATION OF THE EFFECT OF CONVENTIOANL AND REDUCED TILLAGE SISTEMS ON WEED DENSITY IN WHEAT PRODUCTION

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Abstract

The study was carried out in the soil tillage plots which are under long-term period in the Dardanos Crop Production Unit in the 2020-2021 growing season. There were conventional tillage system with mould board plough, commonly used by local farmers, and two reduced tillage (shallow tillage with rototiller, chisel) systems. The effects of these tillage systems were investigated to determine the weed density in dry-wheat production. According to the results, it was observed that rototiller encouraged the emergence of weeds in the early autumn after wheat seeding according to the rainfall distribution. On the other hand, such an effect was observed in the system in which the mould board plough was used, mostly in early spring. Also, chisel, which has no soil mixing effect, was found to be more stable in terms of weed density in both autumn and spring season. The presence of grass per unit area is observed during the period when the highest populations are seen (February-March), such as Petalless Daisy *(Matricaria discoidea)*, Wild Mustard *(Sinapis arvensis)*, Vetch *(Vicia sativa)*, Common Glow Grass *(Veronica hederifolia)* and Pea *(Pisum sativum)*. Among these species, it was observed that the density of Petalless Daisy and Wild Mustard per unit area was 47.34 units/m^2 in the conventional system in which the plow-eared plow was used, while the density of the same species was 617 units/m^2 in the reduced tillage (chisel) system. In the period when the highest grass diversity was detected in the unit area (April-May), Shepherd's Bag *(Capsella bursa-pastoris)*, Goose Beak *(Corydalis)*, Yogurt Grass *(Galium aparine)* and Wild Lettuce *(Lactuca serriola)* varieties were also seen. It was determined that the traditional tillage method at harvest time had the lowest weed density with 3.17 units/m^2, and reduced tillage (chisel) had the highest weed density with 8.37 units/m^2. It has been observed that the tillage system has a significant effect on the presence of weeds in certain periods.

Keywords: *Wild herb, Reduced tillage, Traditional tillage, Crop rotation.*

Acknowledgments: This paper was produced from Osman Mert YAZ of the master thesis data.

‘KSU-46’ WALNUT CULTIVAR

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Abstract

This study aimed to determine the phenological and pomological traits of new walnut cultivar named ‘KSU-46’. This cultivar was obtained from crossing between ‘Maras 18’ x ‘Franquette’. The reason why these cultivars were chosen as parents in the breeding program was that Maraş-18 had very superior fruit traits and ‘Franquette’ was the latest leafing cultivar. ‘KSU-46’ was registered and patented by the Republic of Turkey Ministry of Agriculture and Forestry, Variety Registration, and Seed Certification Center in 2021. In this study, the phenological and pomological traits of ‘KSU-46’ are presented by comparing them with ‘Chandler’ and ‘Maras 18’. ‘KSU-46’ have late season leafing same as ‘Chandler’ and important nut traits. In addition, the cultivar has earlier harvest and defoliation than the ‘Chandler’. Time of male flowering compared to female flowering of ‘KSU-46’ is protandrous. The nut weight, kernel weight, and kernel percentage of ‘KSU-46’ are 12.53 g, 6.35 g and 50.72%, respectively. The nuts of the ‘KSU-46’ have medium size, broad eliptic fruit shape, moderately grooved shell structure and yellowish white kernel. In this study, results indicate that this walnut cultivar have good performance considering some phenological and pomological traits.

Keywords: *Walnut, Juglans regia L., Phenology, Pomology, New Cultivar.*

DETERMINATION OF THE PRODUCTIVITY AND DEVELOPMENT STATUS OF THE SECONDARY BUDS IN THE KARAERIK GRAPE VARIETY

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Abstract

This study was carried out to reveal the size of the secondary buds and the number of clusters they contain in the Karaerik grape variety. In addition, it was tried to determine whether there was a relationship between secondary bud size and cluster outline formation. In the study, winter buds in the first, second and third node of the grape variety Karaerik (*Vitis vinifera* L.), fertile in bottom buds, suitable for short pruning and have a very high table value in the region, were used as material. Secondary buds were separated from the primary and tertiary buds in winter buds with the help of a scalpel and were subjected to fixation, vacuuming, paraffin impregnation, paraffin embedding, freezing, sectioning and tissue staining, respectively. The stained samples were examined microscopically, their images were taken and these images were transferred to the computer, and the secondary bud size and cluster number were determined. In the study, it was revealed that the secondary buds in the second node were statistically different ($p<0.05$) from the secondary buds in the first and third nodes in terms of both cluster number and bud size. In addition, it was determined that there was a relationship between the bud size of the secondary buds in the second node of Karaerik grape variety and the number of clusters.

Keywords: *Secondary bud, bud size, cluster number.*

FATTY ACID DIVERSITY IN CULTIVATED AND WILD APRICOTS FROM EASTERN ANATOLIA IN TURKEY

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Abstract

Turkey is one of the richest countries in the world in terms of both horticulture crop production and diversity. Turkey is origin or second homeland of many fruit species. Diverse climate and soil conditions supports to growth a large number of fruit species, cultivars, genotypes, accessions even clones in the country. During the last two decades due to increasing interest to plant-derived natural products, apricots and its products has been gained more attention not only by consumers but also industries. Present study describes fatty acid profile of cv. Aprikoz and 4 wild apricot (Zerdali in Turkish) genotypes that has sweet kernels. A total nine fatty acids were found in cv. Aprikoz and four wild apricots and statistically significant differences are evident for major fatty acids among all searched cultivar and genotypes. Among the major fatty acids, oleic acid (18:2) were found to be the highest ratio for all analyzed apricot kernels which in range of 67.11% (wild apricot 4) and 70.44% (wild apricot 3), respectively. The other dominant fatty acids were linoleic acid and varied from 19.92% (wild apricot 4) 5) to 22.10% (wild apricot 3). All apricot samples had more monounsaturated fatty acids (MUFA) than saturated fatty acids (SFA) in seed oils. ΣPUFA/ΣSFA were in range of 3.22 and 3.75 among samples. Results indicated that fatty acid compositions of wild apricots are comparable with cv. Aprikoz.

Keywords: *apricot, wild, fatty acids, metabolic profile.*

EVALUATION OF THE EFFECT OF TESBI (*STYRAX OFFICINALIS* L.) SEED EXTRACTS ON SEEDLING DEVELOPMENT OF SOME PLANTS

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Abstract

Many plant species synthesize various biochemical substances from their various organs such as leaves, flowers, fruits, and roots. While some of these biochemical substances have a stimulating effect on the growth and development of other plants, some of them have an inhibitory effect. In this study, the effect of seed extracts of the tesbi (*Styrax officinalis* L.) bush, which spreads naturally in the Mediterranean and Aegean regions, on the seedling growth of sweet fennel (*Foeniculum vulgare* Mill. var. *dulce*), coriander (*Coriandrum sativum* L.), fenugreek (*Trigonella foenumgraecum* L.), camelina (*Camelina sativa* L.) and mustard (*Sinapis arvensis* L.) plants were investigated. In the study, the extracts prepared from the ground tesbi seeds with distilled water at 5% concentration were boiled in three different times (S0: control, S1:15 min, S2:30 min, and S3:45 min). To determine the effects of extracts on seedling growth, seedling height, root length, seedling fresh-dry weights, and true leaf numbers were determined. In S0, S1, S2 and S3 applications, seedling lengths were 14.8-34.5 cm, 9.3-30.4 cm, 12.3-33.5 cm and 10.2-28.0 cm, respectively; root length 5.2-27.0 cm, 4.1-20.1 cm, 6.4-25.6 cm, 4.4-19.5 cm; seedling fresh weight 0.05-0.549 g, 0.033-0.446 g, 0.046-0.136 g and 0.029-0.543 g; seedling dry weight was 0.008-0.123 g, 0.005-0.093 g, 0.007-0.075 g and 0.005-0.074 g and true leaf number was between 1.0-7.0, 2.0-5.0, 2.0-6.0 and 3.0-6.0, respectively. When the findings obtained from the research are evaluated in general, it was found that extracts exhibited an inhibitory effect on seedling growth.

Keywords: *Styrax officinalis, Seed extract, Seedling height, Root Length, Fresh weight.*

THE INFLUENCE OF NITROGEN ON THE GRAIN YIELD AND SOME AGRONOMIC CHARACTERISTICS OF SWEET SORGHUM (*Sorghum bicolor* var. *saccharatum*)

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Abstract

Sorghum species are widely grown in the sub-tropical and temperate regions of the world as animal feed, human food, or bioenergy feedstock. Nitrogen is a crucial component of plant nutrition, and its deficiency limits productivity of crops more than any other element. A pot experiment was conducted to determine the effects of nitrogen levels on the grain yield and some agronomic traits of sweet sorghum (*Sorghum bicolor* var. *saccharatum*). The experiment was carried out at the Bornova experimental fields of Field Crops Dept. of Agriculture Fac., Ege Univ., Turkey, during 2019 second-crop growing season. The experiment was laid out in randomized complete block with four replicates. Seven nitrogen levels (0-50-100-150-200-250-300 kg N ha^{-1}) were tested on grain sorghum cv Sugar-drip. Plant height, panicle length, biomass yield and grain yield were affected significantly in line with higher N rates. The highest grain yield was obtained with the application of 200 kg ha^{-1} N in sweet sorghum under second crop production system.

Keywords: *Sweet sorghum, N level, grain yield.*

POTENTIAL GROWTH AND HERBAGE PRODUCTIVITY OF COMMON BURNET (*Poterium sanguisorba*) AS AFFECTED BY NITROGEN FERTILIZATION

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Abstract

The objective of this study was to examine the effects of N fertilization on herbage yield and plant-yield components of common burnet. A pot study was carried out with six different nitrogen levels (0, 50, 100, 150, 200 and 250 kg N ha^{-1}) on common burnet (Bünyan 80 cv). The experiment was arranged as a completely randomized block design with four replications from October 2019 to November 2020 in the outdoor conditions at Izmir, Turkey. Results shown that rate of N has a significant effect on plant height, fresh and dry herbage yield, and crude protein (CP) yield of burnet. Based on the results of this study, application of nitrogen at the rate of 200 kg ha^{-1} can be recommended for obtaining the maximum yield in common burnet under Mediterranean climate conditions.

Keywords: *N level, Poterium sanguisorba, Dry herbage yield, CP yield.*

THE COMPARISON ANALYSIS OF SOFTWARE FOR MANTEL TEST BETWEEN DNA MARKERS AND MORPHOLOGICAL TRAITS OF PLANT VARIETIES

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Abstract

An advanced approach to the assessment of varieties for the determination of their differences both within the DUS test and breeding is a combination of morphological traits and DNA markers. An implementation of this approach includes a correlation assessment between genetic distances matrices. To this end, the Mantel test is applied. The purpose of the study was to identify the main advantages and disadvantages of different software products for the Mantel test based on correlation investigation between DNA markers and morphological traits of lettuce varieties and maize lines. As a result of correlation calculation between 8 SSR markers and 36 morphological traits of 100 maize lines by XLSTAT (software for Microsoft Excel) p-value (probability of obtaining test results) was 0.0005. The value of this indicator obtained by PASSaGE software was 0.034. There was a p-value of 0.045, which was calculated by GenAlEx 6.5 in Microsoft Excel. A similar result (0.036) was obtained by software environment R. The p-values, which were calculated between 7 EST-SSR markers and 32 morphological traits for four lettuce varieties by XLSTAT, PASSaGE, GenAlEx, and R, were 0.033, 0.039, 0.038, and 0.035, respectively. In the study, the upper-tailed test served an alternative hypothesis type, the level of significance α was 0.05, the type of correlation was Pearson correlation, and the Monte Carlo method was used for p-value computation. Thus, the obtained p-values allow to reject the null hypothesis (H0) and adopt the alternative hypothesis Ha of correlation ($p < \alpha$). The correlation coefficient for maize lines was 0.05 and for lettuce varieties 0.65. Therefore, XLSTAT and software environment R are the most suitable instruments for correlation assessment between genetic distances.

Keywords: *correlation coefficient, maize, lettuce, Mantel, p-value.*

FEATURES OF CHEMICAL COMPOSITION AND TECHNOLOGICAL CHARACTERISTICS OF ROOT OF SUGAR BEET GENOTYPES

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Abstract

Sugar beet breeding aimed at improving root processability involves the selection of breeding genotypes for the content of harmful non-sugars − K^+, Na^+, non-protein nitrogen − directly affecting the technological white sugar yield. The relevant are the researches on the chemical composition of plant organs of sugar beet breeding genotypes, including the content and patterns of ash, macro- and micronutrients, nitrogenous and insoluble substances distribution in order to improve beet processability. As a result of vegetation and field experiments, significant genotypic differences of the pectin substances content in sugar beet roots of Ukrainian and foreign breeding were found. The dynamics of accumulation of various forms of pectin substances in ontogenesis and the phase of development of sugar beet with the maximum accumulation of pectin and protopectin in roots were detected. The studied sugar beet genotypes were cultivated in different soil-climatic zones of the Forest-Steppe of Ukraine. Dependence of the increase in the content of pectin substances in roots from the northwest to the southeast was found. The regularities of changes in technological quality indicators during long-term storage of roots and their affection by phytopathogenic microorganisms were studied. It was proved that hybrids of foreign breeding accumulated significantly more reducing sugars and soluble nitrogenous substances during storage, which negatively affected the juice purity and increased the loss of sucrose in molasses. It was shown that varieties and hybrids of Ukrainian breeding and the hybrid Taltos (Belgian breeding) were the most resistant to affection by phytopathogenic microorganisms. Hybrids of German and Swedish breeding were characterized by a high content of rotten mass.

Keywords: *sugar beet, roots storage, technological quality.*

BIOCHEMICAL PROFILING OF SUNFLOWER HYBRIDS (*HELIANTHUS ANNUUS* L.) IN THE ASPECT OF HERBICIDES RESISTANCE

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Abstract

As a result of biochemical profiling of sunflower hybrids, conservative and variable components of phenolic complexes were detected and potential markers of plant herbicides resistance were identified. They block acetolactate synthase, which is responsible for synthesis of essential amino acids. Phytochemical studies of plant material show that certain difference of quantitative composition of phenolic substances is determined in different sunflower hybrids. A total of 14 individual compounds with typical fluorescence of phenylpropanoids were identified. A significant part of individual compounds is represented by hydroxybenzoic and hydroxycinnamic acids and their conjugates. The stable components of the phytochemical profiles determine typical physiological functions of plant organism. However, the variable part of phenolic compounds determines specific features which characterize hybrids. The strong positive correlation was identified between Matador and Soniachnyi Nastrii hybrids by multiple correlation analysis of biochemical profiles of phenolic synthesis products. The positive correlation was found between Drakon and Aurishybrids. The negative correlation was detected between Drakon and Ukrainskyi F1 hybrids, Auris and Ukrainske Sonechko. Based on cluster analysis results of biochemical profiles, studied hybrids are grouped into three main clusters, which have correlations with herbicide resistance. At distant levels of interrelations, the studied group of hybrids divided into two clusters -tribenuron-methyl resistant and others ones. At closer interrelations level (6.18), hybrids form three clusters, which are consistent with the specificity of breeding approaches, and plant response to herbicides affect. Thus, biochemical profiling of sunflower leaves provides important information of potential regulators of essential amino acids synthesis system, which involves coenzyme flavin-adenine dinucleotide.

Keywords: *sunflower, phytochemical profiles, phenylpropanoids, correlation.*

2.PLANT PROTECTION AND FOOD SAFETY

CHEMICAL ANALYSIS AND SENSORY EVALUATION OF "DOMIATI CHEESE" USING STRAINS ISOLATED FROM ALGERIAN GOAT MILK

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Abstract

A total of 153 wild lactic acid bacteria were isolated from goat milk collected from different areas in Western Algeria. The strains were screened for production and technological properties such as acid production, aminopeptidase activity, autolytic properties, antimicrobial activity and exopolysaccharide production. In general, most tested isolates showed a good biomass separation when collected by centrifugation.As for the production of the lactic acid, results revealed that our strains were weakly acidifying..Nevertheless, lactococci showed a best acidifying activity compared to lactobacilli. Aminopeptidase activity was also weak in most strains, but, it was generally higher for lactobacilli compared to lactococci. Autolytic activity was generally higher for most strains, more particularly lactobacilli. Antimicrobial activity was detected in 50% of the isolates, particularly in lactobacilli where 80% of strains tested were able to inhibit the growth of other strains. The survey of the profile of the texture, the proteolysis as well as the development of the flavor in the Domiati cheese made on the basis of our isolated strains has been conducted during the ripening. The sensory assessment showed that the cheese salted in milk received the best scores in relation to cheese salted after drainage. Textural characteristics, such as hardness, cohesiveness, gumminess and chewiness decreased in two treatments during 60 days of ripening. Otherwise, it was noted that adhesiveness and adhesive force increased in the cheese salted in milk.

Keywords: *Lactic acid bacteria, Technological properties, Acidification, Aminopeptidase activity (AP), Autolysis, Bacteriocin, Exopolysaccharides (EPS), textural properties.*

IN VITRO STUDY OF THE LARVICIDAL ACTIVITY OF HYDRO-ALCOHOLIC EXTRACT *URTICA MEMBRANACEA* POIR. ON *TUTA ABSOLUTA*

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Abstract

In the world, the culture of the tomato occupies the second place after the potato, either in production or in consumption. Since 2008, this culture has been attacking by leaf miner *Tuta absoluta* which larva can attack all phenological stages and causes significant damage. Since its spread, chemical control has been the main control method. However, reduced efficacy of some of the recommended insecticides has been observing. This study concerned the determination of the effectiveness of a bio-insecticide treatment of plant origin from the extraction of the leaves of *Urtica membranacea* Poir., from the Mostaganem region with regard to the larvae of this leafminer. The insecticidal activity of nettle extract against *T. absoluta* larvae was studied in vitro under natural laboratory conditions. Six doses were used: (10%); (15%); (20%); (25%) and (30%). The controls were treated with distilled water and acetone diluted to 10%. The in vitro test made it possible to note that the concentrations 25% and 30% were the most effective. The first and second instar larvae are the most sensitive, the effect of which depends on the nature of the treatment, the exposure time and the concentration. Concerning the effect of the treatments tested on the mortality of the third and fourth stage, an increase in the mortality rate observed as a function of the exposure time and the concentration.

Keywords: *Tomato, Tuta absoluta, Bio-Insecticide, Urtica membranacea Poir, In-Vitro.*

CULTURE OF THE SPECIES *PORTULACA OLERACEA* L. IN THE ALGERIAN OASES OF THE NORTHEASTERN SAHARA

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Abstract

The aimed objective is to make the culture and a biochemical study of the species *Portulaca oleracea* L., known as plant of picking. For that purpose, we returned the seeds of four regions (Ouargla, Touggourt, Djamâa and El-Oued) where the plant is cultivated traditionally and strongly consumed. Its cultivation with the introduction of some cultural techniques reveals the adaptation of this species and the possibility of its domestication in the same way as all the vegetable farming. The biochemical analyses reveal the wealth of the plant in water with 91,16g/ 100 MF, the weak contents in ashes with 2,5/ 100g MS and in proteins with 1,36/ 100 g MR. In fact, we can deduct the importance of the culture of species in Saharan agriculture which can cover the human nutritional needs, given its place in the traditional food and therapeutic systems of inhabitants of the zone of study.

Keywords: *Portulaca oleracea L., culture, domestication, biochemical analysis, northern Sahara, Algeria.*

CONTRIBUTION TO THE DEMONSTRATION OF THE EFFECT OF HIGH TEMPERATURES ON ANTIBIOTIC RESIDUES IN MILK

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Abstract

To compensate for the protein deficit of animal origin, low-income populations usually resort to milk consumption because it's very rich in nutrients and can supplement other expensive products such as meat and it is also subsidized by the state. Given the lack of data on the national status of foodstuffs of animal origin and specifically marketed milk with regard to the presence of antibiotic residues, our study aims is to find their presence in cow's milk in the region of Saida (western Algeria) by an immunochromatographic method (Beta Star Combo). Then, we have tried to test the likely effect of high temperatures (pasteurization at 85 °C for 03 min and boiling at 100 °C for 3 min) on samples contaminated with these chemicals of the raw, pasteurized and boiled milk to verify their stability at different heat treatment. To this end, 544 samples of raw milk have been collected from the collection tanks as soon as they were received at the dairy "source" GIPLAIT group during a period of 04 months (January-April 2019), All samples were analyzed using the Beta star combo kit for rapid detection of antibiotic residues. The results showed that 0.03% of the samples of fresh milk contain antibiotic residues, which major molecules were Tetracycline 80% and Beta-lactam with a percentage of 20%. The same results were found in milk samples after heat treatment (pasteurized and boiled).

Keywords: *raw milk, antibiotic residues, Beta Star Combo, pasteurization, boiling*.

BIOECOLOGICAL STUDY OF THE PSYLL OF THE OLIVE TREE EUPHYLLURA OLIVINA COSTA 1839 (HEMIPTERA: APHALARIDAE) IN NORTH WEST ALGERIAN (MOSTAGANEM, RELIZANE AND MASCARA)

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Abstract

The olive tree (*Olea europea* L.) occupies a privileged place in Algerian agriculture.The phytosanitary problems of this crop constitute the main factor of the decline in its productivity. The olive tree can be attacked by several pests including the psyllid *Euphyllura olivina* Costa 1839 (Hemiptera: Aphalaridae). Our study focuses on monitoring of this pest in the north-west of Algeria (Wilaya of Relizane, Mostaganem and Mascara). The population dynamics of this pest in olive groves shows that all the instars (egg, larvae and adults) are present in the sites during the period from February to early June. Climatic conditions such as temperature are factors limiting the psyllid population since it is absent in summer and winter.Biotic factors, such as auxiliary insects belonging especially to the Anthocoridae family, Cecidomyiidae, play a non-negligible role in the regulation of this pest population.

Key words: *Euphyllura olivina, Population Dynamics, Anthocoridae, Cecidomyiidae, Mostaganem, Relizane, Mascara.*

GRAIN WEIGHT LOSS AND DEVELOPMENT OF SITOPHILUS ORYZAE (L.) ON NEEM INSECTICIDE TREATED WHEATS AT DIFFERENT STORAGE PERIODS

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Abstract

Investigation of neem-based insecticide, Nimbicidine® at 0.75, 1.5, 3.0 and 4.5ml/kg concentrations on three local varieties of wheat *viz*. Gourav Vittee (GV), Protiva MaGho PMG) and Shatabdi Prottaeto (SP) infested with *Sitophilus oryzae* L. adults for 2-8 months storage period was carried out in the laboratory and assess the grain weight loss and consequently the development of adult populations. The experiment was set up with 30 unsexed weevils released on 250g of treated and untreated grains of each replication for two weeks. Weight loss of treated and untreated grains, and number of adult population of the weevil were recorded after 2-, 3, 4-, 6- and 8 months of storage. Nimbicidine® treated wheat grains were found to be less affected than Control batch. Among these three varieties, the variety PMG was tolerant and the variety SP was susceptible to *S. oryzae* infestation. Nimbicidine® significantly reduced the grain weight loss up to 4 months storage period in all wheat varieties but there were no effect during 6-8 months storage compared to Control. Mixing of Nimbicidine® with grains of different wheat varieties the development of adult progeny was significantly reduced throughout all the storage periods. The efficacy of all concentrations of Nimbicidine® gradually increased by inhibiting the emergence of adults in all wheat varieties and storage periods. Application of Nimbicidine to the grains, the loss of grain weight and the subsequent development of *S. oryzae* adult population were dose-dependent and the order of varietal susceptibility varied differently during 2-8 months storage period.

Key words: *Sitophilus oryzae, Nimbicidine®, wheat, weight loss, population.*

VIROLOGICAL RESEARCH ON ŽILAVKA AND BLATINA LOCAL GRAPE VARIETIES

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Abstract

Viticulture is an important economic branch of Bosnia and Herzegovina, with 99% of the concentrated in Herzegovina, in Mostar and Lištica vineyards. The most cultivated autochthonous Herzegovinian cultivars are Žilavka (Ž; 50%) and Blatina (B; 40%). Currently, only standard planting material of CAC category can be purchased for these two cultivars in Bosnia and Herzegovina. The presence of 9 viruses in Žilavka and Blatina cultivars (subjected already to individual clonal and sanitary selection) was assessed by ELISA and RT-PCR assays. Grapevine samples were collected from 20 vineyards and analyzed by both assays. The results showed a high incidence of virus infection and a relatively high number of single infections compared to multiple ones. GLRaV-3 was the most common virus (B - 64.20%, Ž- 82.01%), followed by GFLV (B-54.26%, Ž - 18.34%), and GLRaV -1 (B- 9.37%, Ž-11.15%). Only in Blatina, GFkV was more represented (B-20.45%, Ž-10.79%) compared to GLRaV-1. Other detected viruses were below 3%: GLRaV-4-9 (B-2.55%, Ž -2.87%) and ArMV (B-0.56%, Ž -1.89%), while GLRaV- 2, GVA and GVB were not found in the analyzed grapevine samples. The sequence comparisons and phylogenetic analyses of randomly selected GLRaV-3, GLRaV-1, GFLV, ArMV and GFkV isolates from both cultivars confirmed that all the sequenced isolates belonged to viruses detected previously by ELISA or RT-PCR. A study of the virus incidence conducted from 2011 to 2019 indicates the need to intensify the clonal and phytosanitary selection program, which would create a basis for further steps towards certified planting material for Žilavka and Blatina cultivars.

Keywords: *Žilavka, Blatina, viruses, sequences, certification.*

MICROBIOLOGICAL STATUS OF WATER IN FOOD INDUSTRY OF ANIMAL ORIGIN IN REPUBLIC OF SRPSKA (BOSNIA AND HERZEGOVINA) IN THE PERIOD 2018-2020 IN RELATION TO THE EXAMINED PARAMETERS

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Abstract

Zero-probability level of microbiological contamination of drinking water does not exist. The microbiological quality of water is commonly defined as a maximum acceptable number or concentration of bacteria that do not constitute a health hazard. The experiment used samples of water from food industry of animal origin from the territory of the Entity of Republic of Srpska (Bosnia & Herzegovina) sampled in the period 2018-2020. A total of 390 samples were examined. The aim of this study is to determine the microbiological status of water used in food industry of animal originin Republic of Srpska, in order to identify the risks to food safety. For microbiological testing of water methods BAS EN ISO 6222, BAS EN ISO 7899-2 and BAS EN ISO 9308-1/A1 were used. Research shows that the microbiological status of water used in food industry of animal origin in Republic of Srpska in the period 2018-2020 differs significantly between individual regions. The analysis revealed a significantly higher number of unsatisfactory samples of well water with presence of intestinal enterococci, coliforms and *E. coli*. Water from water supply system has a better microbiological status, but pathogenic bacteria have also been detected in it, which is of concern because it can affect food contamination during the production process.

Keywords: *water, microbiology, food industry.*

REAL TIME PCR AND LAMP METHODS FOR DETECTION OF FLAVESCENCE DORÉE

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Abstract

Surveys for grapevine yellows phytoplasmas in Bosnia and Herzegovina have been conducted since 2004 and vineyards in Srpska region where mostly monitored. In that period, samples have been collected and tested with conventional PCR method with two pair of primers FD9f2/FD9r1 in first PCR reaction and FD9f3/FD9r2 in second PCR reaction. In 2021, the presence of FD was found in one sample of *Alianthus altissima* Mill. and in one sample of alder (*Alnus spp*.) from the area of Laktaši. Through activities of PHYTO-BiH project equipment and reagent donation the presence of phytoplasma in positive samples was confirmed by Real Time PCR and LAMP using FD specific primers. Real Time PCR was done with TaqMan Universal Master Mix with fdgenr and fdgenf primers and probe. After the Real Time PCR was performed, the results were confirmed by an extremely sensitive and fast LAMP detection method. This was the first implementation of the Real Time PCR and LAMP method in the laboratory for certification of planting material of horticultural plants, Faculty of Agriculture in Banja Luka.

Key words: *real-time pcr, lamp, fd.*

Acknowledgment: This work was done through support of "Strengthening of the phytosanitary sector in Bosnia and Herzegovina in line with EU standards", PHYTO-BiH project.

SURVEY ON THE PRESENCE OF *ERWINIA AMYLOVORA*, THE CAUSAL AGENT OF FIRE BLIGHT IN REPUBLIC OF SRPSKA DURING 2016-2020

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Abstract

Considering that quarantine phyto pathogenic bacteria *Erwinia amylovora* (Burrill) Winslow *et al.* was first recorded during 1991 in Bosnia and Herzegovina causing a significant economic damage and that occurrence was registered few more times, surveillance program for the presence of mentioned pathogen was carried out in Republic of Srpska during 2015-2020. The program was approved and financed by Ministry of Agriculture, Forestry and Water Management of Republic of Srpska. Visual inspections and sampling of host plants was carried out in a number of registered nurseries and seedling production places, farms and gardens, as well as imported samples. Laboratory analysis was carried out in accordance with the EPPO Diagnostic protocol for regulated pests PM 7/20 (2): *Erwinia amylovora*, Bulltein OEPP/EPPO, 43 (1), 21–45. Laboratory analyses were carried out in accordance with the EPPO diagnostic: PM 7/20 (2): 2013 OEPP/EPPO Bulletin 43 (1), 21–45. According to this protocol samples were processed by isolation, followed by DASI-ELISA for the serological detection and a conventional PCR for the molecular detection of *E. amylovora*, two screening laboratory tests based on a different principle. Based on the conducted laboratory analysis during 2016-2020, 9 positive samples were confirmed for the presence of quarantine pathogenic bacteria *E. amylovora*, 6 samples in 2017 and 3 in 2020, but considering consequences if bacteria occurs, surveillance program will be continued in 2021.

Key words: *surveillance, Erwinia amylovora, fire blight, Republic of Srpska.*

ASSESSMENT OF *IN VITRO* PROAPOPTOTIC AND GENOTOXIC POTENTIAL OF AGRO BIOSTIMULANT KAISHI ON HUMAN CELLS

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Abstract

The main current soil and crop management strategies depend mostly on chemical-based inorganic fertilizers, which could pose a serious threat to both human health and the environment. By adding nutrients through the natural processes of nitrogen fixation, phosphorus dissolution and other processes that stimulate plant growth, biofertilizers are not only a promising source of essential nutrients for the plants, but also beneficial for the ecosystems. Even though they are used worldwide and considered as safe, biofertilizers and their effects on human health are not fully explored. For the purposes of the present study, the *in vitro* proapoptotic and genotoxic capacity of the plant biostimulant Kaishi were evaluated after 24 h of treatment on normal human fibroblast cell line BJ by fluorescence microscopy after Annexin V/propidium iodide staining and alkaline comet assay. Considerable increase in the number of cells in apoptosis and necrosis was found only after treatment with the biostimulant at the highest concentrations, which substantially exceed those applied in agriculture. Moreover, pronounced induction of genotoxic effects was also detected after treatment with 5% Kaishi compared to the untreated cells and those treated with lower doses. Although the results established a presence of proapoptotic and genotoxic effects of the biostimulant Kaishi it can be considered as relatively safe at doses up to 5%. Nevertheless, further in-depth studies are envisaged to clarify the possible mechanisms of its action in human cells.

Keywords: *Agricultural biostimulant, In vitro safety assessment, Proapoptotic and genotoxic capacity.*

Acknowledgement: This work was supported by the Bulgarian Ministry of Education and Science under the National Research Programme "Healthy Foods for a Strong Bio-Economy and Quality of Life" approved by DCM #577/17.08.2018".

RESISTANCE OF MAIZE HYBRIDS TO EUROPEAN CORN BORER (*OSTRINIA NUBILALIS* HUEBNER) UNDER THE CONDITIONS OF CENTRAL NORTHERN BULGARIA

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Abstract

Maize (*Zea mays* L.) is one of the oldest crops in the world and, as a C4 plant, it shows an incredible increase in biomass. In recent years, a significant number of varieties and hybrids of maize with different tolerance and resistance to diseases and pests have been introduced in Bulgaria. An important pest against which resistance has been created is the European corn borer (*Ostrinia nubilalis* Hb.). The aim of the present work is to monitor the incidence and development of the European corn borer in three maize hybrids in the region of Central Northern Bulgaria. The study was carried out on F1 maize hybrids: ISH714, ISH618, NOSTRANO AGROSUD. Flight dynamic was monitored daily from early May to late September using pheromone traps ZOEKON (ECB-1 capsules). The attack of each hybrid was detected by plant dissection. Damage above and below the cob and the number of larvae in each stem were reported. During the study period 2017-2019, it was found that the hybrids ISH 714 and ISH 618 were attacked equally by the first generation of the European corn borer and there were no proven differences between them. A higher number of larvae were reported in the NOSTRANO AGROSUD hybrid. The ISH 714 hybrid can be defined as the most resistant to the European corn borer, it had the lowest attack and degree of damage, as the differences with the other hybrids ISH 618 and NOSTRANO AGROSUD were statistically proven.

Keywords: *Ostrinia nubilalis, hybrids resistance.*

IDENTIFICATION OF MITES ASSOCIATED WITH CITRUS CROP (*Citrus* sp.) IN THE DEPARTMENT OF CALDAS, COLOMBIA

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Abstract

The study of the relationship between plant diversity and entomofauna constitutes an important element for the design of sustainable agroecosystems. Little research shows the effect of weeds on mite migration from ground cover to crop trees. This study was carried out to evaluate the distribution of mites found in the vegetation cover associated with citrus crops. Commercial orchards were chosen in Caldas, Colombia. The vegetation cover made up of the species *Cynodon dactylon*, *Eleusine indica*, *Emilia sonchifolia*, *Panicum Laxum*, *Solanum nigrum*, *Sorghum halepense* and *Conyza bonariensis* was characterized by evaluating randomly chosen plots in each farm, additionally, leaf and fruit samples of the crops were evaluated. Mite samples were identified to family, genus, or species level as possible. The results show the diversity of mites associated with weeds; *C. bonariensis* was the one that presented the greatest diversity with a total of 13 saprophagous, 21 phytophagous and 34 predatory species. Overall, 45.5% of the species corresponded to phytophagous mite families belonging to the Tenuipalpidae, Tetranychidae, Tydeidae and Tarsonemidae families. A significant number of predatory mite specimen (36.6% of the total) belonging to the Phytoseiidae and Lealapidae families were also found. The groups were differentially distributed in the weeds, which would allow us to know which plants could be unwanted hosts in commercial orchards, as well as to understand better the behavior and distribution of the associated entomofauna.

Keywords: *Mites, Citrus, Weeds, Ground Cover, Colombia.*

EFFECT OF BENEFICIAL BACTERIUM *BACILLUS SUBTILIS* ON THE GREATER WAX MOTH (*GALLERIA MELLONELLA*) MORTALITY

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Abstract

The optimization of crop production led to considerable use of agrochemicals, mostly fertilizers, and pesticides. Residues of agrochemicals in agricultural products and soil pose a threat to the safety of food and the environment. *Bacillus* species produce secondary metabolites and crude enzyme that are exploited as a plant growth promoter instead of synthetic chemicals. *Bacillus thuringensis* is a valuable biopesticide, commercially available and applied worldwide for diverse pest species in all agricultural systems. *Bacillus subtilis* is a gram-positive, beneficial, spore-forming bacterium. It is used in industrial food fermentation since it produces enzymes chitinase, cellulase, glucanase, amylase and proteinase. Chitin is a constituent of an insect cuticle, and chitinase activity can reduce insects nutrient utilization, growth and consequently cause insect mortality. Commercially available products based on *B. subtilis* are considered as an alternative tool for sustainable production in modern agricultural systems. We aimed to test the insecticidal potential of *B. subtilis* on the greater wax moth (*Galleria mellonella*) as a model insect under laboratory conditions. The greater wax moth larvae were treated with Ekstrasol Special, a commercially available formulation of *B. subtilis* Č-13 ($1*10^7$ CFU/cm^3) and *B. subtilis* HC8 ($1*10^7$ CFU/cm^3). The suspension of the products was applied in recommended dose for horticultural crops, and water was used for the controls. The insect mortality was monitored for 72 hours post-treatment. There were no differences between control and bacterial treatment. All tested insect larvae survived the experiment, and bacterial treatment did not interfere with the insects' further development to the pupal stage.

Keywords: *Bacillus subtilis, commercial strain, insecticidal activity, mortality.*

INFLUENCE OF ENDOPHYTIC FUNGI ON WHEAT DISEASE INCIDENCE

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Abstract

Endophytic fungi live inside plants without causing disease symptoms and at the same time provide positive influence on plant resistance to abiotic stress and diseases. Authors have previously isolated endophytic *Fusarium* from symptomless weed growing near agricultural fields and proved positive influence on plant growth and development. The aim of this research was to investigate whether previously isolated endophytic fungi improve disease resistance of wheat. Authors have treated wheat seeds with endophytic *Fusarium solani* and *F.verticillioides* and planted them in the field trials. Disease incidence of the most common wheat diseases has been investigated during the vegetation period and after the harvest. We have found that endophytic fungi reduce disease incidence on wheat compared to control plants.

Key words: *endophytic fungi, wheat, plant disease, biofungicides.*

CONSUMERS' BEHAVIOR TOWARDS FOOD WASTE: A CASE STUDY OF FAYOUM, EGYPT

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Abstract

This paper aims at exploring consumers' behavior towards food waste in Fayoum city, Egypt, through identifying the causes and degree of awareness of Food waste. The results showed that among respondents, there are significant differences between age groups, sex, job categories and frequency of purchase regarding knowledge of food waste. The results clarified that respondents considered offers and discounts in supermarket as a first cause of high Food waste, they thought that it was important not to waste food and food waste created economic damage to the society, where, preparing a list of purchases was considered a first practice of food waste reduction. The results of multinomial logistic model revealed that there was a significant effect of education level, residence, shopping frequency, and sex on the knowledge of food waste. The study recommends organizing campaigns to promote food waste reduction among families and students at universities, encouraging food waste recycling for its environmental, social and economic importance and impacts.

Key words: *Consumers' behavior, Food waste, Multinomial logistic model.*

EFFECT OF SOME POTASSIUM SALTS ON ONION PURPLE BLOTCH INCIDENCE AND SOME PHYSIOLOGICAL AND YIELD PARAMETERS IN ONION SEED PLANTS

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Abstract

Purple blotch disease is one of the most destructive diseases of onion in Egypt, which could cause 100% loss of onion seed production. The excessive use of chemical fungicide harms the environment and natural balance, leading to find another safe and effective alternative controlling onion purple blotch disease. Field experiments were conducted at Demo in El-sultan Bahnas village, Fayoum County at El-Fayoum Governorate during the growing seasons 2017/2018 and 2018/2019on onion for seed production. Plants were sprayed with four potassium salts: K-Silicate, K-Citrate, K_2HPO_4 and K_2CO_3, and two control treatments were one with distilled water and the other with mancozeb 80%. K_2HPO_4 gave the best result in decreasing disease incidence or disease severity in leaves and flower stalks, respectively, followed by K_2CO_3 and K-Silicate,while the treatment of K_2CO_3 gave the highest fresh and dry weights followed by K_2HPO_4, then K-Citrate. The treatment of K_2HPO_4 generated the highest inflorescence and yield components compared to control treatment. K-silicate application exceeded the all other treatments and led to significant increases in free phenols and reduced sugars contents in onion leaves compared to control treatment. Examined Potassium salts in this study gave promised safe alternative control methods for onion purple blotch in onion seed production with reference to the chemical fungicide.

Keywords: *onion seed, potassium, Silicate, Citrate, phosphate and carbonate, purple blotch.*

EFFECT OF POTASSIUM SALTS ON ONION PURPLE BLOTCH INCIDENCE AND SOME PHYSIOLOGICAL AND YIELD PARAMETERS IN ONION SEED PLANTS

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Abstract

Purple blotch disease is one of the most destructive diseases of onion in Egypt, which could cause 100% loss of onion seed production. The excessive use of chemical fungicide harms the environment and natural balance, leading to find another safe and effective alternative controlling onion purple blotch disease. Field experiments were conducted at Demo in El-Sultan Bahnas village, Fayoum County at El-Fayoum Governorate during the growing seasons 2017/2018 and 2018/2019 on onion for seed production. Plants were sprayed with four potassium salts:potassium silicate (K-silicate), potassium citrate (K-citrate), dipotassium phosphate (K_2HPO_4) and potassium carbonate (K_2CO_3). Two control treatments –one with distilled water and the other with mancozeb 80%. K_2HPO_4 gave the best result in decreasing disease incidence or disease severity in leaves and flower stalks respectively, followed by K_2CO_3 and K-silicate. While, the treatment of K_2CO_3 gave the highest inflorescence fresh and dry weights followed by K_2HPO_4, then K-Citrate. The treatment of K_2HPO_4 generated the highest inflorescence and yield components compared to control treatment. K-silicate application exceeded the all other treatments and led to significant increases in free phenols and reduced sugars contents in onion leaves compared to control treatment. Examined Potassium salts in this study gave promised safe alternative control methods for onion purple blotch in onion seed production with reference to the chemical fungicide.

Keywords: *potassium salts, onion, plants.*

ORGANOLEPTIC CHARACTERISTICS EVALUATION OF DIAB MANGO FRUITS AS AFFECTED BY HOT WATER TREATMENTS

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Abstract

Fruit of mango is a perishable fruit with a short shelf-life due to rapid ripeness after harvest. Organoleptic parameters as color, flavor, texture and aroma are specific factors for customer purchase and the marketing of the fresh produce. Hot water treatments (HW) knowhow is achieved popularity worldwide for its probable of ranging shelf life of mango fresh fruits with improved quality. The present study was conducted at the two successive seasons of 2017 and 2018 to evaluate the hot water dipping (HWD) treatments at 45 or 50^{o}C for 5 and 10 min., and then stored at 8^{o}C±2^{o}C and 90-95% relative humidity as shipping simulation for three weeks and then ripened at 20^{o}C too. The sensory characteristics score of mango fruits were measured by panelists who utilized Hedonic test in evaluating the quality scores samples. Our results at the end of ripening storage duration (21days) appeared that the HW treatment at 50^{o}C for 10 min showed the highest significant firm, texture, and pulp color score (3.49, 3.00 and 5.00) of mango fruits compared with untreated ones having exhibited the lower score (1.15, 2.00 and 4.67). Moreover, the sensory score as aroma and flavor, cleared gradual and the same trend, recording the best mango score of aroma and flavor (4.67, 3.67), while control fruits have the lowest taste (3.00 and 2.33).

Key words: *Mango fruit, ripening, sensory evaluation, texture, aroma and flavor.*

SRAP MARKERS ASSOCIATED WITH RESISTANCE TO LOOSE SMUT IN SOME EGYPTA IN BARLEY GENOTYPES

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Abstract

Barley production has been constrained by various factors, of which loose smut (*Ustilago nuda*) is the main biotic factor. Molecular and agronomical screening analyses were evaluated to study the similarity levels and marker assisted selection associated with resistance to loose smut among eight barley genotypes using Sequence-Related Amplified Polymorphism (SRAP). Agronomical parameters during two consecutive 2020 and 2021 seasons were studied to identify their reaction to loose smut. The results exhibited significant differences among all studied genotypes for all studied characters, and the highest mean values for all studied traits were detected in Giza 136 and Giza 137. Six SRAP selected primer combinations were amplified and gave 56 total fragments, where primer combination me1+em3 gave the highest polymorphism (100 %) and the highest polymorphic information content of PIC was (0.96). The dendrogram of SRAP markers had clustered all studied genotypes into two main clusters, cluster I include all the resistance genotypes Giza 136, Giza 137, Giza 123, Giza 132, Giza 138 and Line 2. However, cluster II include only Line 1 and line 3 as a susceptible genotypes. Thus, SRAP marker could be efficiently used to assess genetic variation among barley genotypes and useful for barley germplasm management in terms of biodiversity protection and design of new crosses for loose smut breeding programs.

Keywords: *Hordeum vulgare, Loose smut (Ustilago nuda), Sequence-related amplified polymorphism (SRAP), UPGMA cluster analysis.*

EFFICACY OF TWO NATURAL EXTRACTS AND ANTIOXIDANTS IN REDUCINGPOWDERY MILDEW DISEASEOF BARLEY

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Abstract

This study was conducted to evaluate eight barley cultivars six rowed Giza 123, 124, 125, 126, 2000, 132, 133, 134 for high yield potential and stable performance were tested in controlling *powdery mildew is a common disease of barley crops and is caused by the fungus Blumeriagraminis f, sphordei.*The evaluation was carried out at barley adult plant stages using eight cultivars under green house. All concentrations of two tested inducers were significantly and negatively correlated with each of the biochemical traits. The highest correlation was observed between DS and 1,3- glucanase after 15 days,under open field conditions at Sakha stations Kafr el Sheik Governorates, Egypt in 2020/21 growing seasons. All studied traits were significantly decreased and affected in both growing seasons. Severity and safety they have no toxic residues and environmental friendly and coast effective compared with the ordinary fungicides. This is an explanation of the resistance ratings used in this guide for foliar diseases, and how they should be interpreted: (R) Resistant, (MR) Moderately Resistant, (S) Susceptible, (VS) Very Susceptible .

Keywords: *Barley, Antifungal activity, Powdery Mildew, Inducers, Egypt.*

THE PHYTOSTIM PROJECT (2021-2025): TOWARD AN INTEGRATIVE ANALYSIS OF PHYTOSTIMULANT MODE OF ACTION AND ACCEPTANCE

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Abstract

A European obligation set out in Directive 2009/128/EC establishes a framework for Community action to achieve a sustainable use of pesticides. Biostimulant and biocontrol use is full of promises for a less impacting agriculture on human health and the environment. The project PHYTOSTIM is part of the Bordeaux Plant Science program of the University of Bordeaux, whose ambition is to better understand and master the mechanisms involved in the compromises between biomass production, resistance of plants to biotic and/or abiotic stress and the quality of products from plants. During summer 2021, we start sample collection and biochemical phenotyping on plant tomato cv. M82 cultivated in greenhouses, with or without Stim Pure Liquid treatment, in Astredhor Sud-Ouest station (France). The analyses of the biomass compositionare carried out by an untargeted analysis of metabolic profiles by Near-InfraRed Spectroscopy (NIRS). The leaf samples have been preferred in order to be able to propose realistic protocols for building prediction models. Indeed metabolomics and further analytics devoted to the analysis of biomass composition have emerged as powerful tools enabling the prediction of traits of interest as yield and merchantability. This kind of approach, combined on different species, could represent a major step forward in assessing the impacts of new products and lead to a relevant decision-making tool in the context of a reduction of inputs in agriculture. Preliminary results will be presented during the conference, not only to get feedback from the community, but also to trigger possible collaborations with new partners.

Keywords: *Biostimulant, plant development, predictive biology, sustainable agriculture.*

CRYSTALLIZATION BEHAVIOR OF COCOA BUTTER: THE INFLUENCE OF REGIONAL ORIGIN IN COLOMBIA: TUMACO - HUILA - SANTANDER

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Abstract

Theobroma cacao L., the cocoa tree is a tropical cauliflorous tree that produces pods containing cocoa beans. These beans undergo various stages of processing, resulting in a finished product: chocolate. Cocoa butter constitutes about 55% of the dry weight of cocoa beans ant it is composed of triglycerides. The proportions of their fatty acids vary according to the variety of cocoa, due to climatic, geographical, and genetic factors. This leads to variations in physical properties, such as hardness or melting point, which in terms lead to different organoleptic properties. Those physical properties influence the tempering, one of the most important steps in the manufacture of chocolate, due to the diversity of fatty acids that make up cocoa butter blends. We, therefore, studied chocolate from three different regions of Columbia with different climatic and soil conditions and agronomic practices. It is important to notice that the traceability of different kinds of cocoa butter remains difficult. Studies show that cocoa butter extracted from hybrid cultivars of *Theobroma cacao* exhibit relatively constant melting characteristics. Based on genetic diversity but regional homogeneity, we investigated how this regional difference influences the properties after the crystallization of cocoa butter. Thereafter, we demonstrate a difference in phase behavior. We afterward observe a noticeable contrast in organoleptic characteristics upon flavor release, depending on the regional aviation of growth conditions of cocoa butter.

Key words: *chocolate, innovation, food, structure, cocoa butter.*

VALORISATION OF CAROB FLOUR (CERATONIA SILIQUA L.) IN THE BISCUITRY AND PASTRY SECTORS

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Abstract

The carob tree (*Ceratonia siliqua* L.) is a tree of "great socio-economic interest and numerous potentialities favourable to rural development" Its main production is locust bean gum made from the crushed seeds. One of its co-products is carob flour, obtained after the pulp is ground. Carob flour has interesting nutritional qualities due to its sweetening power (up to 43% of sugars in the composition of unroasted flour according to, its richness in fibre and minerals as well as its nutty taste, which is why it is often cited as a possible substitute for cocoa powder in pastry preparations. Biscuits and cakes cover an infinite variety of ingredients, recipes and products. It is customary to say that biscuits are crunchy and cakes are softer, but there are many atypical or intermediate products. The carob tree (*Ceratonia siliqua* L.) is a tree of "great socio-economic interest and numerous potentialities favourable to rural development" Its main production is locust bean gum made from the crushed seeds. One of its co-products is carob flour, obtained from the roasted and crushed pods. How and in what proportion(s) can it be incorporated into cakes and shortbread while reducing their sugar content, retaining the texturizing properties of the original product and having a pleasant taste? The physicochemical and sensory analyses showed a modification of the texture and sweetness perception of the products with the addition of carob flour. The differences in taste between the prototypes were not significant according to the panel of testers.

Key words: *Carob flour, valorisation, biscuitry and pastry.*

PHYSICOCHEMICAL CHARACTERIZATION AND THE FUNCTIONING OF PLANTAIN BANANA FLOUR BY REPORTING THEIR ORIGIN

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Abstract

Plantains belong to the Musacea family, comprising three genera: Musa, Musella and Ensete. The world production of plantains (BP) reaches about 20 million tons, international trade concerns only 5% of the production. "Self-consumption remains, in fact, the keystone of the plantain market". On the European market, imports grew by an average of 10% per year over the period 2002-2012 . The Ivory Coast, Cameroon and Ghana, with their low contribution, are still niche markets in France . The present study focuses on the determination of the physicochemical characteristics of Colombian, Beninese and French Guyanese plantain (*Musa paradisiaca*) flour. The Beninese and Guyanese flours were purchased and the Colombian flour was made directly from green fruit. The various physicochemical parameters were then determined using conventional methods. The results obtained were subjected to a statistical treatment in principal components. The results showed that the Guyanese flour analyzed was richer in mineral matter (3.52%) and had a higher water content (15.45%) than the Beninese and Colombian flours. However, it is lower in protein (2.77%) and starch (66.11%) than the Colombian and Beninese flours. In terms of water (108.56%) and oil (79.317%) absorption and swelling (118.3%), the Guyanese flour was in the middle range of the other two flours. At the end of this study, hypotheses were put in place to analyze the differences in the characteristics of the flours.

Key words: *Plantain banana flour, physicochemical characteristics, Benin, Colombia, French Guyanese.*

INTRODUCTION AND VALORISATION OF HONEY IN A SEASONAL BEER

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Abstract

Brewing with the incorporation of honey provides a rich array of aromas and flavours that add complexity and character to the beer. It has a high content of fermentable sugars (90-95%) and aromatic substances. In addition, honey is a source of unmalted carbohydrates, which composition and properties are suitable for use as a complementary raw material for malting. It is therefore relevant to study it in the beer making process. The study carried out concerns the variation of the quantity and the moment of introduction of honey in the manufacturing process of the seasonal type beer. It aims to account for the influence of honey on alcohol content, sugar content, density, perception and taste value of honey by the consumer. All-flower honey was introduced into six different brews: 1, 2 and 5% honey at the end of the boiling phase and again at the time of bottling. The seventh control brew without honey was also made. As a result, the increase in the honey percentage and the evolution of the alcohol content are proportional. However, the time of introduction did not give as significant results in relation to the amount added. From the consumer's point of view, samples E and B were globally preferred, which were the samples corresponding to 1% of honey introduction. When honey is added at the time of bottling, the variations in the percentages of honey are more noticeable. In conclusion, the moment of bottling is the ideal stage to introduce honey.

Key words: *Seasonal beer, Honey, valorisation.*

BIOSTIMULANTS IN HORTICULTURE: HOW DIFFICULT IS IT TO VALUE TECHNO-ECONOMIC COMPROMISES?

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Abstract

The EU Regulation 2019/1009,coming into force on July 2022,has adopted a harmonized regulation for all fertilizers and growing mediaand has finally given a framework to biostimulants allowing distinguishing them from plant protection products. There should no longer be any risk of confusion between those two types of products. However, it is not always easy for the farmer wishing to adopt those solutions to know their respective modes of action and efficacy, or to value them in the marketplace. Our study aims atassessing the obstacles limiting the diffusion of biostimulants in horticulture by collecting data, both from the relevant literature and from our own experimental work on the effects of Stim Pure Liquid on two types of horticultural crops: poinsettia and tomato. An integrative characterization of the biostimulant is applied in order to find out about the common descriptors addressing vegetative growth, fruit yield, disease symptoms on leaves and/or fruits. Specific descriptors will also be chosen (aesthetic quality *vs* organoleptic quality). In parallel to those experiments at the plant level, we perform a systematic literature review of the barriers to biostimulantsadoption at the farmer level: technological, financial, market, regulatory barriers. Explaining how descriptors connect with final product's attributes is part of the study. Expected results are: 1) The higher are the barriers, the higher are the compromises between techno-economic and environmental/health performances. 2) The same biostimulantis not subject to the same barriers whether considering the poinsettia value chain or the tomato one.

Keywords: *Biostimulants, Horticulture, Poinsettia, Tomato, Adoption barriers, Techno-economic compromises.*

POPULATION DYNAMICS OF CONFUSED FLOUR BEETLE, *TRIBOLIUM CONFUSUM* JACQUELIN DU VAL IN GRAIN MILLS

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Abstract

This study was carried out at Al-Amina Mill in Homs, central Syria, from the beginning of September 2018 until the end of August 2019. Traps of XlureMst were used to study numerical changes in population of confused flour beetles, monthly and seasonal abundance, number of generations, and relation of these variations with temperature and relative humidity. Three traps were distributed inside different sections in the grain mill. The data of the captured beetles was recorded in traps every week. Daily temperature and relative humidity were recorded. The results showed that the relationship between variations of the population of adults and temperature was positive and significant (r=0.45), while the relationship between it and relative humidity was negative and significant (r=-0.52). The lowest monthly abundance was 0 adults in February, and the highest was 41.33 adults in July. There were four generations, where the first generation was the longest (18 weeks), the second generation was more abundant, while the first generation was the least abundant.

Key words: *Confused flour beetle, Tribolium confusum, Number of generations, Monthly abundance, Grain mills.*

INFLUENCE OF SOWING DATE OF THE MAIZE HYBRID "BASSEL 1" ON THE INFESTATION LEVEL OF STEM BORERS IN DEIR EZ-ZOR REGION, SYRIA

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Abstract

Sesamia cretica Led., *Sesamia nonagrioides* Lef. and *Ostrinia nubilalis* (Hübner) are the most important species of maize stem borers and most prevalent in Syria especially DeirEz-Zor Region. The effect of sowing date of maize crop hybrid "Bassel 1" on the infestation of maize stem borers was studied during the intensive cultivation system at 3 different dates starting at the beginning of July with one weak interval between dates in two consecutive seasons. The infestation rate, infestation density and damage scoring on stems and cones were calculated to estimate the economic losses and grain yield components. The results showed a decreasing of infestation rate and density and damage on stems and cones by delayed sowing date. There was a significant difference between the first and the last sowing date for both consecutive seasons. The infestation rate and damage % to stems were 24.48 and 12.68% respectively, for the first sowing date, and 19.44 and 10.89% respectively, for the third sowing date at the first season. The infestation rate and damage rate to stems were 21.91 and 12.93% respectively, for the first sowing date and 18.19 and 10.20% respectively, for the third sowing date at the second season. This influence was reflected on decreasing the average of economic damage and increasing the average of all grain yield components by delayed sowing date. The average yield was 8.62, 8.91 and 9.19 tons/hectare for the first, second and third dates respectively, in the first season, and 8.88, 9.28 and 9.55 tons/hectare for the same dates scheduled in the second season.

Keywords: *Sowing date, Maize hybrid, Maize stem borers.*

WEED CONTROL IN PARSLEY: COMPARATIVE PHOTOMETRIC ANALYSIS

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Abstract

Invasive weed species in the agricultural environment often pose a health risk for humans. Due to changing climate conditions, agronomists in Western Europe face the problem of contamination of slow-growing commodities as parsley (*Petroselinum crispum*) with fast-growing invasive plants from Mediterranean climatic zones. Groundsel (*Senecio vulgaris*) is the invasive weed in the cultivation of parsley, containing pyrrolizidine alkaloids (PA). Creeping thistle (*Cirsium arvense*) also contaminate parsley due to its sharp thorns. Due to new legal requirements, limiting values for PA, it is mandatory to develop a sustainable solution for a safe crop weed detection and removal. The aim of this study was to identify differences in absorption behaviour of substances, specific for parsley, groundsel and thistle. For finding differences in absorption spectrum, the aqueous-acidic extracts of more than 70 industrial samples were investigated with US/VIS spectrophotometry in the range the between 190 nm and 1200 nm. Whether the IR nor low UV-range show differences between plants. However, significant differences in the individual absorption spectra in the UV-A range have been found. For example, at 342 nm parsley extracts show a significantly higher absorbance than groundsel and creeping thistle. As typical anthocyanin wavelength, it is suggested as marker for distinguishing the plants. The obtained results provide important insights for optical detection of plant species through spectral scans. This detection technology can also be applied for different approaches estimating quality and safety parameters. In combination with mechanical methods, weeds can be detected and removed to decrease application of herbicides.

Keywords: *Parsley, Invasive Weeds, Anthocyanins, Spectrophotometry.*

EVALUATION OF POLYHENOL EXTRACTION FROM APPLE POMACE

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Abstract

Food industry is searching for natural additives because consumers demand natural, safe and environmentally sound food additives. The use of different plant extracts such as grape pomace and cranberry extracts which have antimicrobial effect in food preservation has gained an increasing interest. In the latest years many researches deal with investigation of the antimicrobial effect of apple pomace extracts. Apple pomace, a residue from apple juice production, contains high amount of polyphenols which are known to have antioxidant effect. Apple pomace is a by-product of the apple juice and cider processing industry and represents about 20–35% of the original fruits. It can be used for value-added products, because it is rich in pectin, fibre, macro and micro elements and antioxidants mainly, polyphenols. Previous studies indicate that the apple pomace has high phenolic content and antioxidant activity and thus can be regarded as a valuable source of antioxidants and bioactive compounds. The contents of phenolic compounds vary greatly among different varieties of apples. Moreover, apple peels contain higher concentration of phenolic compounds compared to flesh. Conventional production of apple juice results in a juice with poor phenolic content and with only 3–10% of the antioxidant activity of the fruits that they are produced from. Thus, leaving huge amount of the phenolic compounds in the pomace. Because of this, studying extraction method for extracting high amount of polyphenol from the pomace is important. In this paper apple pomace was dried with different drying method (atmospheric and vacuum ovens, 80° C and 60°C). Extraction was performed using distilled water as solvent, and the extracts were evaluated by the colour, water soluble sugars, total polyphenol content (TPC) and antioxidant capacity.

Keywords: *Food waste, Apple pomace, Drying, Extraction, Antioxidant activity.*

EFFECT OF GELATIN BASED EDIBLE COATINGS ON MINIMALLY PROCESSED APPLE (MALUS DOMESTICA BORKH) CUBES

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Abstract

Apples are rich in bioactive compounds like antioxidants, polyphenols and other compounds having health promoting properties. The shift of modern-day consumer towards fresh, minimally processed, conveniently prepared food is making minimally processed apples more and more popular. Processing of fruits generates physiological stresses in the live tissues even if it is minimal processing. These stresses lead to quality deterioration and shorter shelf life as compared to fresh intact produces. Use of edible coatings is gaining popularity now a days for packaging of fruits and vegetables but not much information is available regarding the use of gelatin based edible coatings on minimally processed apple cubes. The present research work discusses the effect of edible coatings made of gelatin, citric acid and glycerin. Two different concentrations of gelatin, 8% and 10% were used and their effect was seen on carrots against the control samples (carrot samples having no coating). The concentration of glycerin was 2% and ascorbic acid was 1% in both the coating solutions. Apples were cubed, coating was applied using the dipping method. The control and coated samples were stored in ambient conditions. Total polyphenol content, Percent loss in weight, color values, textural analysis antioxidant capacity of apple cubes were recorded for 5 days. Coatings were proved to be good only for retention of total polyphenols and textural properties. It negatively influenced weight loss percent and browning.

Key words: *freshly cut vegetables, carrots, biodegradable, edible packaging, circular economy*.

EFFECT OF PRETREATMENT OF SEED WITH COLD PLASMA ON SOME PHYSIOLOGICAL AND QUALITY TRAITS OF SUNFLOWER (*HELIANTHUS ANNUUS* L.) PLANT IN COMPLETION WITH WEEDS

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Abstract

In order to investigate the effect of cold plasma treatment on some physiological and quality traits of sunflower in completion with weeds, an experiment was carried out as factorial in a randomized complete block design with three replications at Shahrood University of Technology in 2016. Experimental factors included cold plasma at six levels: control, hydro-priming of seeds for 10 hours, pretreatment of seeds with cold plasma radiation for 15 and 30 seconds, hydro-priming of seeds for 10 hours + cold plasma radiation for 15 and 30 seconds and weed control at three levels: control (no weeding), weeding all season and application of trifluralin (1200 g. ai. ha^{-1}). Dielectric barrier discharge plasma jet was operated in ambient air under sterile conditions. After seed priming in distilled water for 10 hours, sunflower seeds were taken in petri plates and treated with the plasma for determined times. Results showed that membrane stability index and carotenoid increased by cold plasma and hydro-priming treatments in weed free than weeds infest conditions. Total chlorophyll content increased by 8.87 and 7.74% in weeding and herbicide application, respectively compared with no weeding treatments. Sunflower seeds protein percentage increased significantly by application of hydro-priming + cold plasma radiation for 30 seconds compared with herbicide application treatment. Sunflower seed oil percent also increased by using cold plasma radiation for 15 and 30 seconds in weed infest treatments compared with weed free and herbicide application condition. Weed density and biomass decreased significantly by plasma compared with control treatment and the most decrease was observed in cold plasma radiation treatment for 15 and 30 seconds. Based on our results, pre-treatment of seeds by cold plasma and hydro-priming in addition to reducing weed biomass, could significantly improve some physiological and quality traits of sunflower through increasing of the crop competitive ability with weeds.

Keywords: *Hydro-priming, Integrated weeds management, Yield quality, Trifluralin.*

THE EFFECT OF EDIBLE COATING BASED ON THE RICE BRAN OIL AND ACETYLATED POTATO STARCH ON QUALITY CHARACTERISTICS OF GRAPE

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Abstract

Use of agricultural products and their wastes as in the production of edible coatings and films has been developed in recent years. In this study, optimization of the edible coating production was carried out using response surface methodology (RSM) and optimal custom design with 20 treatments. Different levels of acetylated potato starch (APS)(3, 5 and 7 gr), rice bran oil (RBO) (0, 0.5, 1, 1.5 and 2 gr) and ultra-thorax rate (homogenization) (0.35×10^{-3}, 1.53×10^{-3} and 3.51×10^{-3} g) were used. Factors such as weight loss, stability and a_w, as the responses of experimental design were considered for investigation. Emulsion gel consisting 6.57 gr of the acetylated potato starch and 2 gr of the rice bran oil produced at 0.35×10^{-3} g homogenization rate was selected as the best combination of edible coating. Effect of the emulsion gel based on acetylated potato starch, rice bran oil was studied on some of the grape's chemical (TA, TSS, pH, weight loss and spoilage percentage) and sensory properties. Edible coating consisting the rice bran oil and acetylated potato starch increased acidity and brightness, but reduced pH and TSS during storage.

Keywords: *Edible coating, Rice bran oil, Acetylated potato starch, Grape.*

IRANIAN KISHK AS A SOURCE OF LACTIC ACID BACTERIA PRODUCING EXOPOLYSACCHARIDE

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Abstract

Exopolysaccharides are high molecular weight polymers composed of sugar subunits. Produced exopolysaccharides by lactic acid bacteria (LAB) play a significant role in improvement of organoleptic properties of fermented dairy products such as yogurt. Diversely, the probiotic function of these bacteria and the prebiotic properties of their produced biopolymers promote consumer's health. For this purpose, a traditional dairy product known as "Kishk" was selected. 143 strains of lactic acid bacteria were isolated from Iranian Kishk in Khorasan Province and cultured in formulated MRS mediums with different sugars such as glucose, fructose, sucrose and, lactose (40 g/L) and incubated in anaerobic conditions at 30 and 37°C for 48 hours. The microscopic features of the isolates were assessed and the production of exopolysaccharide in the culture medium was evaluated by disk and ruthenium red methods. The phenol-sulfuric and weight method were used to quantify exopolysaccharide production. Results showed pH of Kishk samples ranged from 3.60 to 4.08 and the average of total mesophilic count and LAB count of samples were 6.50 and 5.89 log CFU/g, respectively. Analysis of data exhibited 79 out of 143 lactic acid bacteria isolates were exopolysaccharide producer and 70% of them were cocci. The average of maximum and minimum production by weight method were 2.61 g/L and 0.08 g/L, respectively. The average of highest and the lowest amount of exopolysaccharide by phenol sulfuric method were measured 1.87 g/L and 0.06 g/L, respectively. This study indicates the potential of exopolysaccharide production by Iranian native species from dairy products.

Keywords: *Exopolysaccharide, Lactic acid bacteria, Kishk.*

ETIOLOGY AND INCIDENCE OF PISTACHIO ENDOCARP LESION DISORDER IN PISTACHIO ORCHARDS OF KERMAN PROVINCE, IRAN

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Abstract

Pistachio endocarp lesion (PEL) is one of the most important disorders that has spread in the pistachio-growing regions of Rafsanjan and Anar in recent years and has caused great economic losses to farmers. In order to identify PEL symptoms, and investigate the biologic factors involved in the development of this disorder, on May 2016, 90 orchards with different levels of PEL were randomly selected. The rate of development in each tree was scored in-to four levels. The incidence of this disorder was estimated to be 25.8% in Rafsanjan. The seeds with PEL symptoms were differentiated into six types based on the appearance of the symptoms. Then, tissues from infected parts of each type were cultured in the PDA. From among 18 prepared culture media, fungal growth was obtained only in five cultured plates. Isolated fungi were *Ulocladium sp*. *Penicillium sp*., *Verticillium sp*. and *Fusariumsp*. To prove their pathogenicity, the spore spray technique was used on detached cluster *in vitro*. None of the purified fungi caused symptoms similar to the symptoms of PEL. Isolated strains from the pistachio seeds with PEL symptom often were saprophytic and soil borne. They were abundant in the orchard and could be transferred to the shoots of trees under the influence of various factors, such as: tillage, soil splashing by rain drops, and wind. In this study, the role of these fungal agents on the development of PEL was rejected.

Keywords: *pistachio endocarp lesion, Kaleh Qouchi, stylar-end lesion, fungal agents, dark spots.*

INVASIVENESS, DAMAGE, AND MANAGEMENT OF THE SUPERVECTOR WHITEFLY *BEMISIA TABACI* IN AGRICULTURAL CROPS

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Abstract

The whitefly *Bemisia tabaci* is a complex of cryptic species pests that inflict damage in many agricultural crops worldwide, including field, fiber, vegetable and ornamental crops. *B. tabaci* is highly polyphagous and feeds on several hundred plant species and causes damage by direct feeding, weakening plants and secreting honeydew. More importantly, it is a quarantine pest and vectors several hundred plant viruses; some are disastrous, causing extensive economic damage, and threatening the stable food supply, especially in the African continent. *B. tabaci* management heavily relies on using chemical pesticides, however, it is ineffective for the most part because the insect has developed resistance to all major pesticide classes. Recent reports about whole genome sequencing of the two most widespread members of *B. tabaci* complex, the Middle East Asia Minor 1 (MEAM1) and the Mediterranean (MED) (also known as the B and Q biotypes, respectively), shed light on the possible molecular mechanisms that underlay the extreme success of this pest. Most notably, the expansion of gene families related to stress responses and detoxification, and the intimate association of *B. tabaci* complex members with the highest diversity of obligate and facultative bacterial endosymbionts known in insects, has possibly contributed to the invasiveness and adaptation to new environments and niches around the globe. Several aspects of the above mentioned topics and their relevance to the local and global agricultural practices in Israel and worldwide, especially species dynamics, resistance to pesticides and viral disease transmission will be covered in this work.

Key words: *Bemisia tabaci, MEAM1, MED, invasiveness, virus vector.*

A PLANT DISEASE COMPLEX BETWEEN A PLANT PARASITIC NEMATODE AND A FUNGUS - REEVALUATING *PRATYLENCHUS CAPSICI* DISEASE ETIOLOGY

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Abstract

During the last two years we have identified a new nematode species *Pratylenchus capsici* in Israel leading to devastating damage on pepper crop resulting in stunted growth and significant yield reduction. Molecular phylogeography suggests that contemporary gene flow is prevented among different agricultural farms, while population dispersal from weeds (*Chenopodium album* and *Sonchus oleraceus*) to pepper occurs on a relatively small scale. Metabarcoding analysis of soil microbial community from *P. capsici* infested roots indicates that *Olpidium* species are widely presented in *Pratylenchus* introduced root-lesion, and might be a faithful companion associated with roots infected by *P. capsici*. Management strategies to control *P. capsici* population build up in commercial farms including root destruction at the end of season and soil disinfection approaches using different soil fumigants, were studied. Interestingly, implication of fumigant spossessing nematicidial and fungicidial ability greatly inhibited *P. capsici* when compared to the other treatments and enables a sustained growth of pepper production.Migratory ability of *P. capsici* was studied in commercial farm from the end of season, indicating nematodemigration to the lower soil level, resulting in significant higher numbers compared to the upper soil level. Altogether, results obtained through our research will facilitate developing innovative management strategies through tailoring them within the agricultural practices and according to *P. capsici* etiology and characteristics.

Key words: *plant, disease, Israel.*

STUDIES OF *XYLELLA FASTIDOSA* IN THE XYLEM SAP OF OLIVE AND OLEANDER

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Abstract

Xylella fastidiosa (*Xf*) is a xylem-inhabiting bacterium included in the list of the priority pests for the European Union. The pathogen can cause severe diseases on a wide range of cultivated species, as the grapevine Pierce's disease, the phony peach disease, the citrus variegated chlorosis and the olive quick decline syndrome (OQDS). In the last years, several research initiatives have been activated in Europe and in the Mediterranean area due to the establishment of the bacterium in the open field in different countries. The dramatic outcome of Xylella infections in olive in Apulia, Italy, stimulated studies aiming to understand the progress of the disease and the plant/bacterium interactions. In the present work, a protocol was developed to study the bacterium in the plant district in which it lived and multiplied: the xylem tissue. The xylem sap (xs) was extracted using a Scholander chamber from 25-30 cm long cuttings of olive and oleander (2-years old) collected from the *Xf* infected sources. To avoid interference between phloem and xylem extracts, the main stem was debarked and surface sterilized. Xs was then transferred into sterile tubes and kept in ice, prior to perform qPCR and LAMP-PCR for detecting the bacterium directly on the extracts or upon spotting an aliquot on 3MM Whatman paper. Indeed, the purification of bacterial RNA was attempted using different protocols. This method will allow to recover enriched bacterial for transcriptome, ionome and microbiome studies.

Keywords: *Xylella fastidiosa, Xylem sap, Olive, Oleander, LAMP-PCR, qPCR.*

PROFILE OF ANTIBACTERIAL ACTIVITY OF MORINGA OLEIFERA LEAF EXTRACTS AGAINST THE PHYTOPATHOGEN XANTHOMONAS CAMPESTRIS PV. CAMPESTRIS

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Abstract

Xanthomonas campestris pv. campestris (XCC) is the phytopathogenic agent causing black rot in crucifers; once reached the target site in the plant, it damages the plant cells causing maceration of tissues and obstruction of the xylematic vessels. The research of alternatives to pesticides and antibiotics has led to the study of plant extracts with antibacterial properties, and with this optic, the effects of different extracts of Moringa Oleifera (MO) against XCC have been evaluated. Between these extracts, the methanolic, hydroalcoholic and hydroalcoholic with maltodextrin extracts demonstrated bacteriostatic and bactericidal effects at concentrations of 0,5mg/ml, 0,5mg/ml and 0,1mg/ml respectively. All extracts show significant inhibition in biofilm formation and swarming motility and show significant alteration of the cell membrane permeability. It is assumed that the effect is carried out at several levels: phenolic compounds are capable of altering the permeability of the membrane leading to a halt in the ATP-synthesis, resulting in slowing down of all ATP-dependent functions. The modification of membrane integrity and permeability results in a considerable energy reduction as it involves the dissipation of the action potential and the alteration of the electrochemical gradient, necessary conditions for the synthesis of ATP. This alters various ATP-dependent mechanisms, such as motility or biofilm formation. Therefore, XCC, subjected to energy shortages, has an area and a length of movement significantly lower than the untreated control, and a capacity to form biofilms reduced by 87%, 90% and 94% for MeOH-MOE, HAMD-MOE and HA-MOE respectively.

Key words: *Xanthomonas campestris, Moringa oleifera, Antibacterial activity.*

ANTIBACTERIAL ACTIVITY OF MORINGA OLEIFERA LEAF EXTRACTS AGAINST THE PLANT PATHOGEN ERWINIA AMYLOVORA

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Abstract

Erwinia amylovora (EA) is a phytopathogen, causing agent of bacterial fireblight, a disease that affects Rosaceaes. In order to replace antibiotics and copper, the antimicrobial activity of three extracts of Moringa oleifera, methanolic (MeMOE), hydroalcoholic (HMOE) and hydroalcoholic with maltodextrins (HmMOE), was tested on three strains of EA isolated from apple trees by the Emilia-Romagna Phytosanitary Department. MIC and MBC have been evaluated through suspension method and by plate-counting, using a microbial inoculum of 10^6CFU/ml of EA, to which extracts have been added at different concentrations. Biofilm formation, swarming motility and amylovoran production were performed with the crystalviolet, soft-agar assayand the amylovoran method, using a microbial inoculum at a concentration of 10^{5-6}CFU/ml. Extracts were tested at their MIC and subMIC concentrations. All extracts demonstrated bacteriostatic activity at a concentration of 1mg/ml leading to 80% reduction in biofilm formation. HmMOE, MeMOE and HMOE cause an inhibition of motility of 60%, 65% and 30% after 6 days and a decrease of amylovoran synthesis of 84%, 63% and 93%, respectively. The antibacterial activity of the extracts is due to polyphenolic compounds, able to alter the permeability of bacterial membrane, resulting in slowing the synthesis of ATP and consequently of all ATP-dependent functions, such as motility and less selectivity towards harmful compounds which can thus enter the cytoplasm and inhibit enzymes involved in replication and quorum sensing. The efficacy, eco-compatibility and low cost make such extracts a potential toolfor control of bacterial fire blight.

Key words: *Erwinia amylovora, Moringa oleifera, Antibacterial activity.*

DEPENDENCE OF THE CHEMICAL COMPOSITION OF COWSLIP (PRIMULA VERIS L.) INFLORESCENCES ON THE SOIL

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Abstract

At different times of the year plants accumulate different amounts of active substances. Some plants store the active substances in buds or flowers, leaves or stems, and some in fruits, roots or bark. The parts of the plant with the highest content of active substances are usually collected. It is believed that perennial herbaceous plants growing in harsh conditions in unfertilized soils accumulate large amounts of valuable substances. The aim of the study was to investigate the main chemical composition of wild-growing cowslip (*Primula veris* L.) inflorescences from different areas. Plants inflorescences were collected in April–May of 2019 in different regions of Lithuania (area No. 1 – 55°27′ N, 22°45′ E,areaNo. 2 – 55°24′ N, 22°53′ E). The areas were about 10 km away from the main roads. The soil of area No. 2 had almost 4-fold higher mobile phosphorus, 2-fold higher mobile potassium, 1.2-fold higher mobile iron content and 1.5-fold lower total nitrogen content. The number of dry matters, soluble solids, ascorbic acid, chlorophyll *a* and *b*, total carotenoids and crude ash was analysed in plants inflorescences. Higher amounts of dry matter (23.40 %), vitamin C (123.20 mg kg^{-1}), chlorophyll *a* (155.59 mg kg^{-1}) and *b* (263.74 mg kg^{-1}) and total carotenoids (128.67 mg kg^{-1}) were found in the inflorescences of plants collected in area No. 1. In the plants inflorescences from area No. 2 higher content of crude ash (7.52 %) was established. Correlations between soil and inflorescence chemical composition were determined.

Keywords: *Chemical composition, Perennial plant, Soil*.

EXOGENOUSLY APPLIED PUTRESCINE EFFECTS ON ENDOGENOUS IAA IN KIDNEY BEAN AND PEA UNDER LOW-TEMPERATURE STRESS

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Abstract

Plants have developed many adaptive strategies to enhance low-temperature tolerance, including changes in indole-3-acetic acid (IAA) metabolism. Putrescine (Put) is one of the major polyamines in plants, but the role of Put in regulation of IAA metabolism under low temperature is not clear. The aim of this work was to determine the effects of exogenous Put on endogenous IAA content and growth of plants. Common bean and garden pea plants were chosen as plants with different sensitivity to cold. Two concentrations of Put (0.1 and 1.0 mM) were sprayed 30 days after sowing. Later, after 24 h the plants were subjected to low-temperature -1^0C for 24 h at the growth chamber. The amount of IAA was analyzed by HPTLC. The amount of free IAA significantly increased from 8% up to 32% in more tolerant plant garden pea leave sat the intensive growth stage after the low-temperature, while changes in the kidney bean leaves were insignificant. That indicates rapid IAA metabolism, which could be required to maintain developed resistance. Put had greatest influence on the less resistant kidney bean compared with more tolerant garden pea, especially at 1.0 mM Put concentration. Contrary, Put at 0.1 mM caused quantitatively increases in the amount of endogenous IAA in garden pea leaves. Thus, Put caused differences in the content of endogenous growth promoter IAA. Our results reveal that Put act as a regulator in stress signaling pathway and may interact with IAA in legume plants.

Keywords: *putrescine, IAA, low-temperature, kidney bean, garden pea.*

EFFECT OF DIFFERENT RAW MATERIALS POWDER ON TEXTURE AND COLOUR PROPERTIES OF YOGURT BITES

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Abstract

In this research, different freeze-dried raw materials powders were used as a functional ingredient in yogurt bites formulations. The aim of this study was to establish the effect of rosehip fruit, beetroot, nettle and mulberry leaves powders on texture and color characteristics of yogurt bites. The yogurt bites were prepared by mixing the Greek yogurt with different raw materials powders. There were five treatments: 1. control (yogurt bites without raw materials); 2. yogurt bites with 1% rosehip fruit powders; 3. yogurt bites with 1% nettle leaves powder; 4. yogurt bites with 1% mulberry leaves powder; 5. yogurt bites with 1% beetroot powders. The yogurt samples were placed in silicone molds and immediately frozen at −35^{o}C. After 24 hours, the samples were lyophilized using a Freeze-Drying Plant Sublimator 3×4×5 (ZIRBUS Technology GmbH, Bad Grund, Germany). Textural properties of the yogurt bites were determined by texture analysis. The color of the yogurt bits was measured with the ColorFlex spectrophotometer and expressed as L, a, and b values. The results showed that incorporation raw materials powders (except rosehip fruit powders) increased hardness of yogurt bites. However, control yogurt bites showed higher consistency and cohesiveness. The supplement of different raw material powders led to a decrease in brightness of yogurt bites. The value a (redness) significantly increased after the addition of beetroot and rosehip fruit powders, compared with control treatment. Yogurt bites prepared with rosehip fruit, nettle and mulberry leaves powder showed increase in b value (yellowness). The addition of nettle and mulberry leaves powder in yogurt bites gave them a more greenish color.

Keywords: *yogurt bites, hardness, texture, color, rosehip fruit.*

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CHANGES IN FRUIT SIZE AND BIOCHEMICAL COMPOSITION OF VIBURNUM OPULUS FRUITS DURING RIPENING

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Abstract

Fruits of *Viburnum opulus* are very popular not only in folk medicine, but they are also used for production of food and medicinal products. Biologically active compounds of these fruits could help in heart diseases and colds, digestive disorders and internal bleeding. In this study, the dynamic of fruit biochemical compounds during ripening and fruit size changes were determined. It was found that the average weight of a fruit did not increase after the stage of technical maturity. Quantity of ascorbic acid changed from 18.3 mg/100 g to 44.3 mg/100 g. At the stage of biological maturation, sugars and soluble solids were detected in different quantities. However, the highest titratable acidity was determined in unripen fruits (ripening stage I).

Keywords: *cultivar, biochemical compound, fruit, maturation.*

STUDIES ON THE DIVERSITY OF PHENOLIC COMPOUNDS IN ACTINIDIA KOLOMIKTA BERRIES

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Abstract

Previous studies on composition of biologically active substances showed that berries of different *Actinidia* Lindl. species were distinguished by both quantitative and qualitative diversity of phenolic compounds. The variability of phenolic compounds is a factor influencing the quality and taste of *Actinidia kolomikta* (Rupr. et Maxim) berries also. The aim of this study was to investigate phenolic compounds in berriess of different *A. kolomikta* cultivars and clones. Plant material was collected in *Actinidia* field collection of Botanical Garden of Vytautas Magnus University.Berry samples were gathered at the technical maturity stage and lyophilized at a condenser temperature of -85 °C. The total phenolic content in the ethanol extracts of *A. kolomikta* berries was determined by the Folin–Ciocâlteu method. Separation of phenolic compounds was performed with Acquity H-class UPLC system. The highest total amount of phenolic compounds was found in berries of the cultivar 'Krupno plodnaja' and the lowest amount was detected in berries of the clone La3, 24.52 mg/g and 8.03 mg/g, respectively. In berries of different *A. kolomikta* accessions, four groups of phenolic compounds were detected, i.e. hydroxycinnamic acids, flavones, flavan-3-ols and flavonols. Statistically reliable differences in individual phenolic compounds were determined among berries of different cultivars and clones. Various amounts of (-)-epicatechin and procyanidin C1 from the group flavan-3-ols, kaempherol-3-O-glucoside, quercitrin and rutin from the group flavonols and chlorogenic acid were found in berries of all cultivars investigated. Flavonols (+)- catechin, isorhamnetin, kaempherol, and quercetin were also detected in berries of almost all cultivars and clones studied. From the group of flavones, apigenin was the most common, acacetin was found only in berries of two clones of Lithuanian origin. These results corroborated the high value of *A. kolomikta* berries because of diversity of phenolic compounds.

Keywords: *Actinidia, berries, cultivars, phenolic compounds.*

The EFFECT OF DRYING TECHNOLOGIES ON THE Quality of Dried Beetroot powder

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Abstract

Vegetable powder can be used as natural pigments or as functional components in different food products. Beetroots are one of the most widely consumed vegetables; they are rich in nutritional value, vitamins and minerals also provide intensive color for the food. Depending on the food, mostly beetroots processing is required, before the use for enrichment of other food products.The aim of this work was to study the effect of conventional drying, lyophilization and spray drying on the quality of organically grown 'Scarlet', 'Jollie' and 'Kestrel' varieties beetroots powder. Chemical composition and physical properties of beetroot powder dried in different ways were estimated. Using standard methods, content of total phenolic compounds, anthocyanins, and betalains was determined as well as color. Conventionally dried beetroots powder had significantly lower amounts of phenols comparing with the lyophilized and spray dried. The highest quantities of phenolic compounds (2.47 GRE mg g^{-1}) and anthocyanins (1.61%) were found in lyophilized 'Scarlet' variety beetroot powder. The lyophilization was more pronounced for the betacyanin and betaxanthin content in beetroots powder. The highest betacyanin amount was found in lyophilized and spraydried 'Scarlet' beetroot powder, while the highest quantity of betaxanthin in spray dried 'Scarlet' powder. The most intense red color was distinguished by 'Scarlet' variety spray dried beetroots juice powder (33.94 NBS units).

Keywords: *beetroot powder, lyophilization, convection air flows, spray drying*.

RADIOACTIVITY LEVELS IN SOME MUSHROOM SPECIES COLLECTED FROM MACEDONIA AND CONSEQUENT DOSES

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Abstract

Mushrooms are bioindicators in the environment that accumulate radionuclides, therefore they can pose a radiological threat. In the Republic of Macedonia, mushrooms are widely consumed as a part of the diet, for this reason their radiological control is required. In this research, the activity concentrations in different types of mushrooms (Boletus edulis, Marasmius oreades, Morchela conica, Lactarius deliciosus) were determined. The mushrooms were collected from six different locations in the Republic of Macedonia, and information on the radiation dose for the general population were obtained with this measurement. The analyses were performed by means of HPGe gamma spectrometry, i.e. an instrument - gamma spectrometer (Canbera Packard) with a high purity germanium detector. The obtained spectra from the measurement were analyzed by using the GENIE 2000 program. On the basis of the performed tests, the mean values for the activity concentrations in the mushrooms were as follows 41.9±1.2 Bq kg − 1 for 226Ra, 40.3±1.8 Bq kg − 1 for 232Th, 83.75±6.2 Bq kg − 1 for 40K, and 2.34±0.24 Bq kg − 1 for 137Cs. The mean value of the radiation risk index H_{eks} is lower than the maximum allowed value which is <1 for H_{eks}. The value of the radium equivalent activity Ra_{eq} is below the maximum recommended limit, i.e. 370 Bq kg-1. Significant variations were not observed in regard to the activity concentrations of 137Cs and 40K in the same mushroom species from different sampling points. High activity concentrations of 137Cs activity were not detected in any of the mushrooms. The researches in this study show that all mushroom samples pose no biological threat, i.e. it was found that the analyzed radionuclides do not pose a health risk and the levels are below the international standards.

Key words: *mushrooms; gamma-ray spectrometry; natural radioactivity; food safety.*

RADIATION LEVELS IN SAMPLES OF DICALCIUM PHOSPHATE (DCP) WITH A GAMMA SPECTROMETRY METHOD

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Abstract

Radioactive contamination of living organisms and body tissues primarily depends on the level of contamination of the food they consume, and to a lesser extent on drinking water and inhalation. The aim of this study was to determine the level of radioactivity present in dicalcium phosphate (DCP) samples used as a feed additive. DCP is used as a major source of phosphorus and calcium because it strengthens the skeleton and accelerates the growth of the animal. It is therefore important to familiarize yourself with these levels as part of this radioactivity is likely to be transmitted to humans through the food chain. Measurements were made in order to determine the risks that those quantities may bring. Radioactivity levels are measured using a standard spectroscopic system with a high-resolution HPGe detector. The mean values for the measured activities in the DCP samples were 5.27Bq.kg-1 for 226Ra, 2.87 Bq.kg-1 for 228Th. The mean value measured for 40K was 22.26 Bq.kg-1, respectively. From the results obtained for DCP, it can be seen that the activity of 226Ra is significantly lower than the activity of 228Th, while the value measured for 40K in the samples does not pose a risk to human health, even to animals, because potassium is an essential mineral for living organisms. Considering that the radioactive contamination of the tissues of the animal body originates primarily from the level of contamination of the used animal feed, as well as from the water used for irrigation of the animals, a preventive measure is to control the radioactivity of the feed in their use, i.e. the concentration of radioactive isotopes should be as low as possible, ensuring that they do not pose a threat to the animal organism.

Key words: *DCP, gamma spectrometry, feeds.*

VARIABLE COMPONENTS DETERMINING THE PRIMARY RESISTANCE TO EXTREME TEMPERATURES OF THE WHEAT SEEDS REPRODUCED IN DIFFERENT CLIMATIC ZONE

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Abstract

Specific results of our research have shown that the primary resistance of wheat genotypes varies depending on the conditions of seed reproduction. In laboratory conditions, based on the evaluation of the seeds' germination capacity after their exposure to shock with high or sub-zero temperatures, we determined the resistance of different wheat genotypes reproduced in Moldova and Ukraine. The wheat varieties can be differentiated in the accelerated mode after their primary resistance to extreme temperatures (excluding the influence of the adaptation processes carried out during plant ontogenesis) by exposing them to heat shock or shock with negative temperatures well-prepared for germination seeds. The resistance of different wheat genotypes seeds to extreme temperatures can vary, being influenced by the environmental conditions of their reproduction. Only a tiny part of genotypes demonstrated at the same time the high resistance to high and sub-zero temperature. As a rule, genotypes with high resistance to negative temperatures have a low level of resistance to high temperatures. In most cases, the primary resistance to negative temperatures of seeds reproduced in Moldova was lower than those produced in Ukraine. Overall, the obtained data support the view that the resistance of seeds of different wheat genotypes to extreme temperatures reflects the interaction between the primary resistance of the genotype and the influence of epigenetic inheritance factors on the seed resistance.

Keywords: *Triticum aestivum L., seeds, heat and frost tolerance.*

BACILLUS AMYLOLIQUEFACIENS I3: AN EFFECTIVE BIOCONTROL AGENT IN THE INDUCTION OF SYSTEMIC RESISTANCE IN *ARABIDOPSIS THALIANA*

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Abstract

The bacteria *Bacillus* species were described as inducers of plant systemic resistance in relation to their antagonistic activity. The objective of this study was to evaluate the effect of selected strain of *Bacillus amyloliquefaciens* (I3) on inducing systemic resistance in *Arabidopsis thaliana* as a model for plant molecular genetics. The microorganisms were identified and confirmed for their antagonistic potential *in vitro* and *in vivo* in previous studies. In order to explore this mechanism, two mutants of *A. thaliana* carrying a *PR1* promoter (a conventional marker of salicylic acid (SA) pathway) and *LOX2* promoter (a marker triggering jasmonic acid (JA) pathway activation) were analyzed after inoculating antagonists. Transgenic reporter line analysis demonstrated that *B. amyloliquefaciens* I3 induced *A. thaliana* defense pathways by activating SA and JA at a high level compared to lines treated with chemical elicitors of references [acibenzolar-*S*-methyl; Bion 50 WG, SA, and methyl jasmonate]. The efficacy of *B. amyloliquefaciens* I3 in inducing the defense mechanism in *A. thaliana* was demonstrated in this study.

Keywords: *seed treatment, Bacillus amyloliquefaciens I3, salicylic acid, jasmonic acid, β-glucuronidase.*

INTERFERENCE COMPETITION BETWEEN LADYBIRD BEETLE ADULTS (COLEOPTERA: COCCINELLIDAE) ON PRICKLY PEAR CACTI PEST *DACTYLOPIUS OPUNTIAE* (HEMIPTERA: DACTYLOPIIDAE)

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Abstract

The outbreaks of mealybug, *Dactylopius opuntiae* (Cockerell) (Hemiptera: Dactylopiidae) have created problems to Prickly Pear crops in Morocco in recent years. The native ladybird *Hyperaspis campestris* (Herbst 1783) (Coleoptera: Coccinellidae) and introduced ladybird *Cryptolaemus montrouzieri* (Mulsant, 1853) (Coleoptera: Coccinellidae) were used to control this menace. Petri dishes were used to determine the minimum number of *D. opuntiae* females that females of the introduced ladybird beetle *C. montrouzieri* require per day to achieve maximum fecundity and to assess the effects of interference competition from conspecific and heterospecific [*Hyperaspis campestris* (Herbst 1783)] adult ladybirds on its growth and reproduction. The number of *D. opuntiae* females at which females of *C. montrouzieri* ate most, and achieved maximum reproduction was 30. The presence of *H. campestris* does not significantly affect the reproductive numerical response of *C. montrouzieri* females. The presence of a conspecific or heterospecific (*H. campestris*) did not significantly affect the mean number of clutches laid by *C. montrouzieri* females. Also, mean clutch size and number values were significantly increased as prey density increased from 3 to 25 and does not significantly change from 25 to 30 density. The mean number of clutches laid by *C. montrouzieri* females was independent of the presence or sex of another lady beetle. Based on these results we suggest that the population abundance of *C. montrouzieri* will not be affected by the native ladybird *H.campestris.*

Keywords *Coccinellidae, Dactylopius opuntiae, Hyperaspis campestris, Interference competition.*

EVALUATION OF QUALITY AND SHELF-LIFE OF FRESH AND FLESHY CUCUMBER STORED IN CHARCOAL COOLER BIN IN THE TROPICS

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Abstract

Adiabatic evaporative cooling is a concept and process adopted for extending shelf-life of fresh fruits and vegetables in tropics. This study evaluated the performance of Charcoal Cooler Bin (CCB) and its effects on the quality and shelf-life of cucumber. The storage microclimate and ambient conditions (air temperature and relative humidity) were measured using data logger developed for the purpose of this research consisting of a micro-control unit (MCU), a logging device and sensors. By monitoring the physiological and quality parameters, the effects of the storage media: CCB, open-air, refrigerator and laboratory conditions on the storability of cucumber, and effectiveness of the CCB for fresh cucumber preservation through percentage weight loss, visual quality, degree of shriveling, colour changes and life expectancy were evaluated. The CCB had an average cooling efficiency of 75.56%, an average relative humidity and temperature of 94.71% and 23.22^{o}C for the storage period. The CCB markedly maintained freshness, reduced weight loss (with weight loss of 3.4696% after the storage period relative to cucumber samples stored in the refrigerator, laboratory and open-air condition with 8.4176%, 9.8260%, and 11.2696% respectively) and extended the shelf-life of cucumbers fruits at CCB environmental conditions. Cucumber stored in the CCB were still acceptable for 14 days with weight loss of less than 5% while refrigerated, laboratory and open-air samples were acceptable for 9, 6 and 5 days having weight loss greater than 5% respectively. Therefore, CCB passive system is an inexpensive and reliable storage medium for reducing postharvest losses in a sustainable manner.

Keywords: *Charcoal cooler bin, cucumber, shelf-life, quality, evaporative cooling system.*

CHITOSAN MEDIATED IMPROVEMENTS IN OSMOSIS AND METABOLITES OF HEAT STRESSED COTTON

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Abstract

Among all the abiotic stresses, high temperature stress, especially at flowering, is the major factor causing substantial reduction in cotton yield. To check the effect of foliar applied chitosan (CH), a derivative of chitin, for inducing thermo-tolerance during flowering stage in cotton. A field experiments was conducted at University of Agriculture Faisalabad, Pakistan during summer season of years 2016 & repeated in 2017. The experiment was laid out in Randomized Complete Block Design with split arrangement and replicated thrice. The treatments were comprised of heat stress in main plots at flowering stage for 4 and 8 days and varied chitosan concentrations (0, 0.2, 0.4, 0.6 and 0.8 g L^{-1}) were applied foliarly after imposing heat stress in split plots. Heat stress was imposed by making the plastic tunnels using perforated transparent polythene sheet. High temperature stress reduced leaf total phenolic contents, total soluble proteins, turgor potential, relative leaf water contents and seed cotton yield. Application of chitosan @ 0.8 g L^{-1} induced thermo-tolerance by improving all the recorded parameters under high temperature stress while application of chitosan @ 0.6 g L^{-1} improved the bio-chemical, physiological and yield components under ambient conditions. Conclusively, high temperature stress adversely affected the recorded response while foliar application of high dose of chitosan ameliorated the adverse effects of heat stress at bio-chemical and physiological levels.

Keywords: *Gossypium hirsutum, Terminal heat stress, Lipid peroxidation, Yield components.*

BIOLOGICAL CONTROL OF FUSARIUM WILT OF TOMATO BY APPLICATION OF *PENICILLIUM* SPP. AND *CHENOPODIUM MURALE*

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Abstract

Fusarium wilt of tomato, caused by *Fusarium oxysporum* f. sp. *lycopersici*, is an economically important soil-borne disease of tomato especially in warmer regions of the world. Fungicides used to control this disease also pollute the environment and cause health hazards. In the present study, this disease was controlled by application of two antagonistic species of *Penicillium* namely *P. digitatum* and *P. expensum*, and dry biomass of a weed *Chenopodium murale* as soil amendments. The antagonistic fungi and different doses of dry biomass of the weed (1%, 2% and 3%) were applied in pathogen inoculated pot soil either separately or in combinations. The highest disease incidence (100%) was recorded in positive control where only fungal pathogen was applied. Different treatments of soil amendments reduced disease incidence to 3–23%. The lowest disease incidence (3%) was recorded in 2% *C. murale* biomass + *P. expensum* treatment. All the soil amendment treatments significantly enhanced shoot and root growth as well as fruit yield as compared to positive control. The highest fruit biomass was recorded in 2% *C. murale* biomass + *P. digitatum* treatment. The highest activities of peroxidase (POX), catalase (CAT) and polyphenol oxidase (PPO) were recorded in the positive control. These enzymatic activities were significantly lowered when soil was amended with antagonistic fungi or *C. murale* biomass. Effect was more pronounced where *C. murale* biomass was applied either alone or combined with *Penicillium* spp. This study concludes that application of 2% *C. murale* biomass + *P. digitatum* has the potential to significantly reduce Fusarium wilt of tomato and enhance tomato growth and yield.

Key words: *Fusarium disease, tomato, yield.*

FUNGI TOXIC PROPERTIES OF FOUR QUINOA VARIETIES LEAF EXTRACT AGAINST *MACROPHOMINA PHASEOLINA*

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Abstract

Quinoa (*Chenopodium quinoa*Willd.), family Chenopodiaceae, is a newly introduced crop in Pakistan. Various *Chenopodium* spp. growing as weeds in Pakistan possess antifungal potential against *Macrophomina phaseolina*, the cause of root diseases in hundreds of species of plants. This study was done to check antifungal potential of quinoa leaves against this notorious soil-borne pathogen. The pathogen was isolated from diseased mungbean plants and identified on the basis of morphological characters and further confirmed using universal and specific primers namely ITS, β-tubulin, GADPH and MPRT. Methanolic leaf extracts (1, 2, 3, 4 and 5%) of four quinoa varieties namely V1, V2, V7 and V9 were evaluated for their antifungal activity. Various extracts suppressed fungal biomass by 36–87%. Extract of V7 exhibited the best activity, reduced fungal biomass by 73–87% and was, therefore, selected for further bioassays. This extract was fractionated using three organic solvents of variable polarities namely *n*-hexane, chloroform and ethyl acetate. Antifungal bioassays were conducted using 8 concentrations (1.562 to 200 mg mL^{-1}) of each fraction. All the concentrations of chloroform fraction completely controlled (100%) growth of the pathogen. *n*-Hexane and ethyl fractions were comparatively less inhibitory and caused 32–100% and 35–100% reduction in fungal biomass, respectively. GC-MS examination of V7 leaf extract chloroform fractionpossess potent antifungal compounds against *M. phaseolina.*

Keywords: *Antifungal constituents, chloroform fraction, quinoa, leaf extract, Macrophomina phaseolina.*

IN VITRO PROFILING OF ASSOCIATED MYCOFLORA WITH ANTHRACNOSE OF MANGO INCITED BY *COLLETOTRICHUM* SPP, ITS MANAGEMENT AND DEVELOPMENT OF MODEL

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Abstract

Among the post-harvest diseases, mango anthracnose gains more importance as it limits the shelf life and exports of fresh mango ultimately leading to serious economic losses. Symptoms of mango anthracnose appears on leaves, panicle and also on fruit. Necrotic spots with irregular shape developmainly on both sides of the leaf. Anthracnose of mango is a disease complex as the recent studies reveal that other fungal species of *Colletotrichum* are also involved. The ultimate objective of research was to survey the orchards of Multan division which is recognized as the mango cultivation belt for the evaluation of disease severity and disease incidence. The division of Multan was divided into four zones. Disease intensity was founded most in Northern region. Potato dextrose agar was used for in vitro isolation. For investigating whether this pathogen is responsible to cause this disease or not, purification and microscopic characterization were performed. Through using poisoned food technique, five chemical based selected fungicides as Score, Topsin-M, Bavistin, Cabriotop and Nativo were evaluated against the pathogen to manage the disease under in vitro conditions. Score was proved to be the best as it gave maximum efficacy at all concentration as 25, 50, 75 and 100 ppm followed by Topsin-M and Bavistin for inhibition of colonial development of *Colletotrichum* spp. Cabriotop and Nativo were least effective as they gave minimum efficacy. All fungicides have shown the best results as their concentration increased from lower to higher. To forecast prevalence of disease during the season and to manage the disease attack in time a regression prototype was designed by conducting epidemiological studies which revealed that except maximum temperature all parameters including sun shine hours, relative humidity at dawn and dusk affect the happening of mango anthracnose. By using regression model developed through statistical analysis, the response of climatic parameters was assessed. Research summarizes thatan integrated strategy should be implemented to control mango anthracnose through utilizing the evidence from regression model by studying meteorological variables.

Keywords: *mango, disease, management.*

MODELLING OF UNSTEADY SPATIALLY DISTRIBUTED FOOD DRYING PARAMETERS ASSESSED NON-DESTRUCTIVELY (FOOD IMAGING) IN A SMALL INDUSTRIAL FOOD DRYER

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Abstract

Modelling of unsteady moisture diffusion in relation of food temperature during drying operation becomes complex due to complexity involved in solving complex numerical equations. In this study, a simplified methodology (determination of drying parameters: lag factor and drying constant) was used to model change in food quality with its temperature in an industrial dryer using potato slices (6 mm thick, 60°C). A shift able real time data acquisition box was developed to acquire the food image. Linear and exponential models were developed to estimate product quality as a function of dimensionless moisture ratio, linked with change in product temperature. The experimental and models predicted color kinetics using variable values of lag factor and drying constant revealed good correlation coefficients ($R2 = 0.88\text{-}0.99$, $P < 0.0001$). The change in spatially distributed quality parameter with product weight loss was successfully assessed and modelled unsteadily, providing a better way to optimize the design process as a function of food physiognomies in an industrial dryer.

Keywords: *Unsteady modelling, Real time data acquisition, image analysis.*

EXTARCTS FROM LAMIUM ALBUM AS A NATURAL SOURCE OF BIOACTIVE COMPOUNDS – ALTERNATIVE TO CHEMICAL CROPS PROTECTION

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Abstract

Lamium album has a wide variety of biological activities due to its various phytochemicals such as iridoids, flavonoids, triterpenes, fatty acids, polysaccharides, saponins, phytoecdysteroids, phenolic acids, amines, essential oils, and tannins. In this research, supercritical CO_2 extraction is applied to extract bioactive compounds from *Lamium album*. Extraction was performed at various temperatures using methanol as co-solvent. The collected extracts were characterized in terms of antioxidant capacity by using DPPH, ABTS and FRAP *in vitro* antioxidant activity assays, whereas the Folin–Ciocalteu procedure was employed to estimate the total phenols content (TPC). On the other hand, phenolic compounds in the extracts were quantitated by liquid chromatography coupled with a photodiode array detector (UPLC-PDA) and confirmed with a mass detector (TQD). The extracts have shown high TPC ranged between 234.17 to 650.17 mg GAE/g extract. DPPH scavenging of the extracts was estimated and obtained EC50 values ranged from 0.123 to 0.406 mg/ml of solution. The ABTS radical scavenging activity ranged from 43.20 to 44.53 µg TE/g. The FRAP value was found within the range of 19.48 to 44.74 µmol TE/g of extract. Differences between extraction conditions were observed. In this research, 50°C/250 bar was efficient for the TPC, DPPH, ABTS, and FRAP assays; moreover, statistically, TPCs and FRAP assay showed significant differences between the conditions at α=0.05. The identification of phenolic compounds in the obtained extract of *Lamium album* flowers, using UPLC/PDA, revealed that chrysin, pinostrobin, myricetin, and *trans-3-hydroxycinnamic* acid were present at high concentration what correspond with the high content of polyphenols and antioxidant activity. The results obtained indicated that SC-CO_2 could be considered an alternative method for extracting of bioactive compounds of *Lamium album*. High antioxidant activity and the presence of various bioactive compounds indicate the potential of this plant from the *Lamiaceae* family and the possibility of its application in agriculture, as an alternative to chemical crops protection.

Keywords: *Lamium album, bioactive compounds, antioxidant assays, supercritical fluid extraction, UPLC/PDA.*

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YIELD AND QUALITY OF TVAROG MADE FROM THE MILK OF SIMMENTAL COWS DEPENDING ON THE MILK PRODUCTION SEASON

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Abstract

The aim of the study was to assess the yield and nutritional value of the traditional Polish cheese (tvarog) made from the milk of Simmental cows obtained in two production seasons (summer and winter). In the summer the cows grazed in the pasture *ad libitum*, while in the winter their diet was based on grass silage and maize silage. The tvarog was made in laboratory conditions using pure cultures of mesophilic lactic acid bacteria. The following parameters were determined in the milk samples: pH, basic chemical composition and the concentrations of fat-soluble vitamins. In the tvarog samples, the content of protein, fat, water, fat-soluble vitamins, texture parameters and colour intensity were determined. In addition, the yield of tvarog and the degree of retention of protein and vitamins were estimated. The results indicated that the yield and quality of the tvarog was integrally linked to the quality of the raw milk used. Higher cheese yield was obtained from milk from the winter season, which could be associated with its higher content of protein and casein. Content of fat-soluble vitamins was higher in the raw milk obtained in the pasture season as well as in the tvarog produced from it. A high degree of retention of fat-soluble vitamins from milk to cheese was noted as well (over 90%), with higher values in the tvarog from the pasture season. With regard to texture parameters, the hardness and adhesiveness of the cheese were found to increase with its content of protein. Cheese made from milk obtained in the summer had more yellow colour, which may be due to the higher content of vitamin A in this milk.

Keywords: *Raw milk, Traditional Polish cheese, Pasture season.*

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THE INFLUENCE OF POLYOLS USED AS OSMOTIC AGENTS IN OSMOTIC DEHYDRATION PROCESS

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Abstract

Osmotic dehydration (OD) is a technique used in food technology for the partial removal of water from plant tissues that often precedes different preservation treatments, especially drying. The OD process can improve the food product quality and reduce energy consumption in the next processes allowing to create new products. It positively affects retention of flavour, colour and nutrients and causes a reduction of both water content and water activity of a dehydrated material. Many factors have an impact on the efficiency of OD (e.g., temperature, time, solution type and concentration, the ratio of the mass of the dehydrated product to the mass of the solution, the sample geometry, the material structure). For the OD process, different types of agents might be applied. One of the most common osmotic agents is sucrose solution. However, because of the worldwide epidemic of obesity, there is an increasing demand for its less-caloric alternatives. In recent years, the use of polyols as the osmotic agents is widely investigated due to their low energy value and a comparable sweetness to sucrose. The aim of this study is to discuss the applicability of chosen substances from the polyol group as the osmotic agents. The sugar profiles, kinetics parameters and sensory properties of dehydrated food products with the use of polyols are analysed. Literature review points out that some substances from the polyol group can successfully be alternatives to sucrose in the OD process. Erythritol and xylitol is the most studied and promising osmotic agents of sugar alcohols.

Keywords: *osmotic dehydration, polyols, sugar alcohols, plant tissue*.

FOOD SAFETY AND NUTRITIONAL PROPERTIES OF SOME EDIBLE MUSHROOMS

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Abstract

Although more than 140,000 species of fungi are known, less than 25 are widely accepted as food and only a few have reached the level of commercial product. However, wild edible mushrooms have been used for centuries as food and flavoring, due to their unique and delicate taste. Wild mushrooms are becoming increasingly important in diet not only for their nutritional and sensorial values, but also for their pharmacological properties. The wide variety and abundance of minerals are the most common characteristics of mushrooms. Ten edible mushroom species (wild growing and cultivated) were analyzed through ICP-MS technique to evaluate their content in minerals, both in cap and stipe. The concentrations of some microelements and heavy metals in the substrate of the analyzed mushroom specieshave also been determined in order to establish if the mushrooms are bioaccumulators for a certain element. *Russula atropurpurea* had the bioaccumulation factor of zinc greater than 1, both in the cap and stipe, while in macromycetes of Agaricales order the bioaccumulation factor of copper was supraunitary in cap. High amounts of zinc and chromium were accumulated by *Pleurotus ostreatus*. Referring to macroelements, the concentration of sodium ranged between 75.40 mg/kg (*Russula nigrescens*, cap) and 552.40 mg/kg (*Macrolepiota procera*, stipe). Higher concentrations of potassium were accumulated in cap than in stipe of mushrooms, with an average value by 6503.54 mg/kg. The potential synergistic effects between essential and non-essential metals of 10 edible mushroom species were taken into account.

Keywords: *Mushrooms, Nutritional value, Essential metals, Heavy metals.*

ENTOMOPATHOGENIC EFFECT OF SOME *BEAUVERIA* ISOLATES ON THE TOMATO LEAF MINER *TUTA ABSOLUTA* (LEPIDOPTERA: GELECHIIDAE) LARVAE UNDER LABORATORY CONDITIONS

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Abstract

The tomato leafminer *Tuta absoluta*, a pest recently spread in Europe is already considered the biggest threat to greenhouse tomato crops in southern Romania. The phenomenon of resistance generated by the continuous use of chemical insecticides is becoming more and more obvious for the tomato producers and lead to the need for efficient solutions and development of alternative pest management strategies, based on the use of specific predators, parasitoids, nematodes, plant extracts or pathogenic microorganisms. The present study aimed at examining the efficacy of two local *Beauveria* strains, used separately or simultaneously with two predatory bug species and their interactions against the larvae of *Tuta absoluta* on tomato plants under laboratory conditions. The fungal treatments were done with concentrations of 1×10^5, 1×10^7 and 1×10^9 conidia ml^{-1}. Seven days after treatment application, both *Beauveria* isolates induced a *Tuta absoluta* mortality above 80%, the best results being registered in case of combination between the use of *B. pseudobassiana* isolate at a concentration of 1×10^7 conidia ml^{-1} and the predator *Arma custos*. No side-effects on natural enemies used in combination indicate these isolates as promising alternative for *Tuta absoluta* control.

Keywords: *Tuta absoluta, Biological control, Beauveria isolates, predatory bug.*

THE INFLUENCE OF THE ESSENTIAL AMINO ACIDS IN CEREALS ON THE NUTRITIONAL QUALITY OF FOOD

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Abstract

World trade in wheat is higher than all other crops combined. In 2017, world wheat production was 772 million tons, and in 2019 766 million tons, becoming the second most produced cereal after corn. Wheat is an important source of carbohydrates. Global wheat demand has increased due to the unique viscoelastic properties of gluten proteins, which facilitate the production of processed foods, whose consumption increases as a result of the global industrialization process and the westernization of the diet. Wheat flour is a main ingredient in foods such as bread, oatmeal, muesli biscuits, pancakes, pasta and noodles, pies, pastries, pizza, semolina, cakes, cookies, muffins, buns, donuts, breakfast cereals. In the manufacture of wheat products, gluten is important to provide viscoelastic functional qualities in the dough, allowing the preparation of various processed foods, such as bread, noodles and pasta. Nutrition 100 g of wheat contains 327 kilocalories and is a rich source of several nutrients, protein, essential amino acids, dietary fiber, manganese, phosphorus and niacin. Ordinary wheat contains on average 12.7% protein and a significant share of essential amino acids that are part of flour products often consumed by young people, especially in their favorite dishes.[1](https://www.libertatea.ro/lifestyle/grau-proprietati-beneficii-contraindicatii),[2](Savu CV, Gheorghiu A, Barna O.et all, 2019 Influence of food behavior and physical activity in relation to the overall physical condition of Romanian students. Progr Nutr 2019; 20, 21(4): 1003–10).

Keywords: *essential amino acids vs wheat, flours.*

DIFFERENTIATED HERBICIDES APPLICATION ON WINTER WHEAT CROPS USING OFFLINE INSTRUCTIONS MAP

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Abstract

Plant protection measures, including control of weeds, are significant part of production cost. The average annual growth of pesticides world market, during the period from 2010 to 2019, had showed 2.8 % rise , its volume reached in 2019 – 55,650.00 million dollars without VAT, while the Russian market showed an increase of more than three times -10.8 %, the market volume in 2019 was 2081.00 million dollars without VAT. The continuous use of herbicides negatively affects both the economic efficiency for agricultural crops cultivation and the environmental situation. The use of differentiated plant protection technologies, in terms of herbicides application may increase the efficiency of agricultural enterprises, as well as reduce the pesticide pressure on the environment. The research work was carried out on the experimental farm of Perm Agricultural Research Institute – division of Perm Federal Research Center. The experimental plots located on heavy loamy sod-podzolic soil. The object of research was winter wheat, variety "Skipetr". The study showed the effectiveness of differentiated application of herbicides on winter wheat in the Ural region, using the in offline mode. The grain yield reached 5.63 t ha -1 after differentiated application versus 5.10 t ha -1 with conventional technique, and 4.22 t ha -1 at the control. The herbicide pressure on cultivated areas was reduced by 46 % in average, and the economic efficiency of production increased by 40 % compared to areas where overall treatment was carried out with average recommended herbicide doses.

Keywords: *differentiated plant protection, herbicide, winter wheat, precision farming, task map.*

THE USE OF POTASSIUM SALTS UNIQUE PROPERTIES FOR SUPPRESSION OF POTATO PATHOGENS DURING STORAGE PERIOD

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Abstract

Natural sylvinite has the property to produce light air ions due to air molecules contact with potassium and sodium cations. Such environment has the ability to inhibit the growth of potato pathogens. In given report the results of different methods of medium saturation with light negative ions are presented. The studied treatments were following: the surface from bulk sylvinite; aerosol generator (blowing air through salt filters). The filters with lumpy sylvinite filling and special pills from pressed sylvinite were used. Various modes of airing regimes were evaluated – three and six hours a day. The safety of tubers for the storage period, as well as the qualitative set of potato pathogens were assessed. The least number of infected tubers was noted in treatments with "pill"salt filter with three hours ventilation regime and the surface from bulk sylvinite (0.56 and 0.57%, respectively), the largest number of diseased tubers - in the control variant - 1.18%. The smallest mass loss of tubers in the period from January 29 to April 14 was recorded in the treatment with pill salt filter with with three hours ventilation regime - 1.53%, the maximum loss - when using a surface from bulk sylvinite - 2.9%. After studies in typical storages equipped with standard ventilation systems, a technology for potato storage, based on the creation favorable air environment saturated with negative air ions and saline aerosol, will be developed.

Key- words: *potato storage, sylvinite, air ions, salt aerosol, potato pathogens.*

THE NEW RACES OF *PUCCINIA HELIANTHI* SCHWEIN ON SUNFLOWER IN THE RUSSIAN FEDERATION

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Abstract

Over the past two decades, a wide spread of rust on sunflower in the Rostov, Saratov, Krasnodar, and other regions of the Russian Federation was observed. The identification of the racial structure of *P. helianthi* populations in Russia has not been done since the early 80s of the last century. At that time, races 100 and 300 were identified in Russia. In our recent study, we identified six races among the isolates of the rust pathogen collected between 2017 and 2019. In addition to the indicated races 100 and 300, we identified, for the first time, the new races: 700, 710, 722 and 772. The aim of this study was to determine the racial identity of 160 *P. helianthi* isolates collected in the period 2018-2020 in the Rostov, Saratov, and Krasnodar regions. We used eight standard differentiating lines of sunflower: SM-90, SM 29, R-386, HAR-1, HAR-2, HAR-3, HAR-4 and HAR-5. We used also the sunflower variety VNIIMK 8883 as a differentiator susceptible to all races of the pathogen. In addition to 6 races mentioned above, we identified 11 more new races for the first time: 304, 351, 352, 364, 704, 736, 740, 741, 745, 760 and 762. Race 700 prevailed among the isolates collected in the Rostov region in 2020; we also identified single specimens of races 760, 762. Thereby, we found 17 races of *P. helianthi* on sunflower in three regions of the Russian Federation. It is possible that other races are also present here, so further research is required.

Keywords: *sunflower, rust, Puccinia helianthi, races, regions.*

INVASIVE INSECT SPECIES IMPORTANCE AND POSSIBLE PATHWAYS OF THEIR SPREADING IN SERBIA

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Abstract

Invasive insect species are alien species that have significant impact on biodiversity of certain area or specific country, and also can cause severe damage to cultivated plants. Many insects spread actively, but very often benefit from human activities and use transport of trades and passengers to travel all around the globe. Directions and stopover of these stowaways are usually unpredictable hence the importance of insect monitoring and investigation of their spreading pathways are of great importance for the country, and even for the whole potentially endangered region. One of the currently most important Hemipteran species, recorded for the first time in 2015 in Serbia, is Brown Marmorated Stink Bug, *Halyomorpha halys* Stål (Pentatomidae). The species has been monitored for five consecutive years and nowadays it is considered as well established in the country. On the other side, another cosmopolitan Hemipteran species, in Serbia known as tobacco white fly, *Bemisia tabaci* (Gennadius) (Aleyrodidae) was recorded on the territory of Serbia in 2016 and 2017, but since then specimens of this species have not been recorded neither outside nor in green houses during regular monitoring, why it is considered as not established. Samples of both species were analyzed based on COI gene and results revealed similarities with populations from Egypt, Syria, and Turkey in case of *B. tabaci* MED species, while *H. halys* populations from Serbia showed high haplotype diversity represented by five haplotypes, indicating multiple sources of invasion. All possible ways of spreading will be discussed.

Key words: *Brown Marmorated Sting Bug, Tobacco whitefly, monitoring, establishment, COI.*

CONTROL OF ELATERIDAE AND *GRYLLOTALPA GRYLLOTALPA* IN THE TOMATO CROPS

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Abstract

In order to obtain high and stable yields of tomato, one of the very important factors, is successful protection in the initial stage of the growing period against harmful insect species like Elateridae and *Gryllotalpa gryllotalpa*, which is achieved by insecticides application. The aim of the paper was to test the efficacy of insecticide tefluthrin in tomato protection against mentioned pests. The field trials were conducted in 2020 in the region of Vojvodina province at the localities Ruski Krstur (RK), Crvenka (C), Šajkaš (Š) and Budisava (B) on tomato crops, variety Amerikanac and Alparac, according to standard OEPP methods (PP 1/46; 1/152; 1/135). Insecticide based on tefluthrin (5 g a.s./kg, GR) at the rate of 12 and 15 kg/ha was applied, simultaneously with planting tomatoes. Plot size was 160 m^2 per variant and consisted of four replications. The effect of insecticide was derived based on the number of plants, from the four central rows, in the distance of 10m, as well as the number of damaged plants from Elateridae larvae and *G. gryllotalpa*. The first assessment was performed after 15 days of tomatoes planting. Efficacy (E%) of the insecticide was determined according to Abbott, while the significance of differences was evaluated by the LSD test (5%) by ANOVA. At the locality RK, insecticide treatment provided 18-27.9% higher number of plants in comparison to the control. The number of plants damaged by Elateridae and *G. gryllotalpa* was significantly reduced by insecticide use (1.5-5.3%) with regard to the control (18.9%). Efficacy of the tefluthrin was 71.9-92.1%, depending on the applied amount. Also, in the C locality, a significant reduction in the number of plants damaged by soil pests compared to the control (10.6%) was established after the use of tefluthrin (0.7-1.5%), while efficacy was in the range of 85.8-93%. At the locality Š, a significant reduction of the damaged plants percentage (0-1.5%) was registered compared to the control (8.5%), while 15 days after the treatment efficacy was in the range of 81.9-100%. A slightly lower reduction of damaged tomato plants was obtained by the use of tefluthrin in locality B where the efficiency was 72.8-83%, depending on the applied amount.

Key words: *tomato, Elateridae, Gryllotalpa gryllotalpa, tefluthrin.*

OCCURRENCE OF OCHRATOXIN A IN RED WINE IN SERBIA IN 2020-2021

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Abstract

Wine production in Serbia has a long tradition and represents one of the significant branches of agricultural production. Wine produced in Serbia has, for many years, a reputation of good quality products. Health benefits of wine related mostly to cardiovascular diseases are well known. However, wine is also recognized as one of the main contributors to the dietary intake of ochratoxin A. Ochratoxin A is a widespread mycotoxin that is produced by several *Aspergillus* and *Penicillium* species and main mycotoxin occurring in wine.In this study, a total of 55 samples of red wine were collected from 18 producers from Serbia in the period 2020-2021. The samples were analyzed for ochratoxin A (OTA) content by using an enzyme-linked immunosorbent assay Ridascreen® Ochratoxin A 30/15. The occurrence of OTA in the tested samples was 89%, with average concentration of 0.47μg kg^{-1} and maximum OTA content of 1.04 μg kg^{-1}. These results suggest very high level of occurrence of OTA in tested samples. The limit of 2.00 μg kg^{-1} imposed by Serbian legislation for OTA content in wine was not exceeded in any of the studied samples. It could be concluded that levels of OTA in wines from Serbia do not pose a risk for human health.

Key words: *wine, ochratoxin A, ELISA.*

DISSIPATION DYNAMICS OF ANTHRANILIC DIAMIDE INSECTICIDES IN SOME FRUITS

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Abstract

Nowadays for the control of a wide range of insects pests, different chemical groups of insecticides are available on the market, but in spite of that inappropriate agricultural practice often leads to pest resistance development, as well as various harmful effects on human health or the environment. To overcome these, a few relatively new class of insecticides, as spinosines and anthranilic diamides, are developed. However, even if they are applied in accordance with good agricultural practices, the pesticides may leave residues, and cause side effects on human health. Due to this, it is very important to evaluate the persistance of pesticides in the agroecological conditions where they are applied mostly. In this paper behavior and the fate of the anthranilic diamides, chlorantraniliprole and cyantraniliprole, in peach, sweet cherry and pear fruits were evaluated. Field trials were conducted at different localities in Vojvodina, Serbia. Products based on cyantraniliprole and chlorantraniliprole were foliar applied at the recommended rate, for the control of main peach, sweet cherry, and pear pests. The extraction procedure of insecticides involved a widely used QuEChERS-based method, while residues were analyzed by HPLC-DAD. Methods were validated according to SANTE criteria. The half-life (DT_{50}) of cyantraniliprole in peach and sweet cherry fruits obtained in this study was 2.5 and 3.0 days, respectively. Furthermore, chlorantraniliprole dissipated rapidly in peach and pear fruits, with half-lives of 3.15 and 2.76 days. This study suggests that chlorantraniliprole and cyantraniliprole could be safely used in peach, sweet cherry and pear orchards, with an important role in the control of insecticide resistance.

Keywords: *anthranilic diamide, dissipation dynamic, peach, sweet cherry, pear*.

MICROBIOLOGICAL QUALITY OF SURFACE WATER AND SAFE VEGETABLE PRODUCTION

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Abstract

Good microbiological quality of irrigation water has a great importance for health-safety agricultural production. In order to avoid microbiological contamination of crops, the microbiological quality of the water supplying the crops should be monitored. The aim of this paper is investigation of the microbiological quality of the water from 5 channels and one pool from the municipality of Surcin which can potentially be used for irrigation, as well as determination the microbiological quality of the vegetables which are irrigated from the pool. Microbiological parameters of water and vegetables quality are determined by the standard methods prescribed by the Rulebook on parameters of surface waters (MPN method) and Rulebook of food hygiene of production of Republic of Serbia. The values of the tested parameters in one of the five investigated channels, Surcin channel water, were higher in relation to the limit values of the Rulebook. The increased levels of total and fecal coliforms, Escherichia coli, Salmonella, and Shigella were found. The Surcin channel water requires appropriate treatment before its use for crop irrigation. The values of other tested waters did not go beyond the limit values prescribed by the Rulebook, but for the safer agricultural production their treatment is recommended. Microbiological analyzes of vegetables were also done. The total and fecal coliform bacteria, as well as E. coli, Salmonella sp. and Shigella sp., were not detected in the tested vegetable samples.

Key words: *microbiological quality of irrigation water, coliform bacteria, E. coli, Salmonella sp.*

THE OVERVIEW ON THE FUMONISINS PRESENCE IN DURUM WHEAT GRAIN IN SERBIA DURING THE PERIOD 2015-2019

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Abstract

Durum wheat is a cereal with high range of vitamins, minerals and other nutritional compounds which are important in human nutrition. Durum wheat selection programs in Serbia are smaller in scope compared to bread wheat, but this does not diminish their importance. Good grain quality is essential for the grinding and food industry. Therefore, it is important that durum wheat is safe to consume. Fumonisins are mycotoxins synthesized mainly by fungi of the genus *Fusarium*. These toxins occur usually in maize and maize products, although their presence has also been reported in other cereals such as wheat and barley. In a five years period, 2015-2019, durum wheat samples were tested for the presence of fumonisin. Samples were collected from different plots in the Zemun Polje. Each year, 10 randomly selected durum wheat grain samples were tested. The grains were dried, ground and analyzed for the presence of fumonisin. The analysis was performed by ELISA (Enzyme-linked immunosorbent *assay*) using a kit for fumonisin, Tecna, Italy. The highest concentrations of fumonisin were recorded in 2016 when the values ranged 30.602-43.930 ppm. Medium concentrations (8.872-18.477 ppm) of synthesized fumonisin were recorded in 2015, while in other years (2017, 2018 and 2019) fumonisins were observed in low concentrations (0.024-6.124 ppm). Since previous analyzes have shown that fumonisins are present in durum wheat every year, it is necessary to continue monitoring their appearance in durum wheat, as well as in other small grains.

Key words: *Durum wheat, Fumonisins, Fusarium, Serbia.*

OVERVIEW OF MOLECULAR METHODS FOR DETECTION OF „*CANDIDATUS* LIBERIBACTER SOLANACEARUM"

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Abstract

„*Candidatus* Liberibacter solanacearum" is a gram-negative, fastidious bacterium that inhabits and multiplies in phloem of the host plants. The bacterium causes economically important diseases of solanaceous crops and cultivated species from Apiaceae family. Being unculturable, the bacterium is detected and characterized by application of molecular methods. Thus, different variations of a specific DNA fragment chain amplification have been in use (classical PCR, real-time PCR, multiplex PCR, nested and LAMP PCR). The real-time PCR showed the highest sensitivity compared to the other PCR methods. By comparing CaLsppF/CaLsppR and LsoF/HLBrprimers, results showed that LsoF/HLBr primers possessed higher sensitivity, where the detection threshold was 1.6×10^3 bacteria in 1 g of plant tissues. However, their specificity was 92.6% compared to the CaLsppF/CaLsppR pair of primers detecting all strains tested so far.In the classical PCR method, the CL514F/CL514R pair of primers showed the greatest specificity and efficacy. Among conventional PCR detection methods, nested-PCR showed 20 to 50 times higher sensitivity while LAMP PCR showed up to 100 times higher sensitivity compared to classical PCR. The aim of this paper was to raise an awareness about importance of this bacterium and difficulty to study it by summarizing the protocols and molecular methods for its detection and characterization.

Keywords: *„Candidatus Liberibacter solanacearum", molecular detection.*

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EFFECT OF MILIGARD IN CONTROL OF *Cercospora beticola*

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Abstract

Sugar beet is grown on about 35000 ha in Serbia. The choice of varieties and production technology are determined by seed houses and sugar factories. Varieties that are high-yielding with a higher percentage of digestion but are susceptible to the most important diseases such as *Cercospora beticola, Rhizoctonia spp*. Every year, at the end of the season after the extraction of sugar beet roots, the susceptibility of some yielding varieties of sugar beet to leaf and root diseases threatens the profitability of sugar beet. To control *Cercospora beticola*, the most common combinations of synthetic fungicides are used in registered quantities. Their efficiency and amount of application in some sensitive varieties proved to be insufficient. There is a possibility of fungicide resistance due to frequent application. In order to avoid these problems of resistance and application of the same fungicides, it is of interest to introduce new mechanisms of action. Miligard fertilizers with the active substance Kphosphonate have appeared on the market, which increases the alkalinity between pH 8-9 per leaf. Under these conditions, *C.beticola* spores do not germinate. There is no possibility or occurrence of resistance and potassium and phosphorus in the form of phosphonates can benefit sugar beet in terms of increasing yields and sugars and by increasing the resistance of proteins. In order to increase the alternation with synthetic fungicides in the form of new mechanisms of action on *C. beticola*, it is of special interest to examine the action of Miligard in field conditions and compare it with standard fungicides, which was the aim of this study. A microexamination was set up in PSS Sombor, on the variety Smart Belamia, KWS production, which is most often grown in the region of Sombor due to the declared tolerance to *C.beticola* and *R. solana*, high yields and resistance to ALS herbicides.The experiment was set according to the standard OEPP (1996) PP I / 1 (3), in 6 variants, 3 repetitions, the size of the basic plot 20m². In each replication, 50 leaves were examined, 10 leaves per plant.Grades are performed before the first treatment and then after each treatment. In our experiment, there were enough plants / leaves and the efficiency was determined by counting the spots on 50 leaves per variant. The mechanism of action is expressed in the increase of the alkaline reaction of the K and P complexes (Potassium phosphanate) acts on Cercospora beticola spores. However, alkalinity can only be achieved in water, so treatments with Miligard require treatments immediately before rain or before infections. Miligarda works well if an alkaline reaction is achieved in the rains before the infection. However, after drying, there is no alkaline reaction and no action. The application of Miligard requires a more precise determination of the time of application, ie only before the rain.

Key words: *Cercospora beticola*, mycoses, sugar beet, protection.

THE PROGNOSIS OF *CYDIA POMONELLA* L.THE MOST SIGNIFICANT PESTS OF APPLES

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Abstract

The prognosis of *Cydia pomonella* L. appearance in apple plantations enables proper undertaking of protective measures without harmful effects on man and useful organisms. The indication pest extermination deadlines improve the efficacy of protection and diminishe the appearance of toxic substances in apple fruit. The aim of this work is to point out the significance of methods for the prognosis of pest appearance as the basis for pest suppression and the rational application of pesticides. The paper is accompanied by a flight of *Cydia pomonella* L. at two sites in Rasina district.The pest presence determination visually, by the usage of feromone traps, by calculation of efficient temperatures, enables the proper application of chemical protective measures, as well as the production of healthy organic food achieving the preservation of the environment. Among the areas with extremely suitable ecological conditions for intensive production of apples is the Rasina district. The modern growth of apples as a high intensive growing of fruit species iwass threatened by many economically important pests and pathogens. In order to suppress them effectively and economically, it is necessary to monitor the upgrowth of apple pests, to make the prognosis of their appearance and signalize the terms of treatment.

Keywords: *prognosis, indication, codling moth, apple.*

THE RESISTANCE OF AUTOCHTHONOUS VARIETIES OF APPLES AND PEARS ON *ERWINIA AMYLOVORA*

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Abstract

Erwinia amylovora, a bacterial blight of apple fruit, is one of the most important diseases of apples and pears. It is very difficult to suppress the disease and sometimes the infection is 100% and practically the fruits are not for use. Bacterial blight caused by E. amylovora belongs to the group of the economically most significant diseases of apple fruits. Since E. amylovora parasitizes all the organs of the plant (flower, fruit, skeletal branches, and trunk) and causes necrosis and tissue damaging on them, this bacterium is considered as one of the most destructive pathogens. With further significant spread of the infection in the Republic of Serbia, due to insufficient, superficial, or non implementation of measures to protect sensitive host plants, even more significant economic losses from the quarantine bacteria E. amylovora, should be expected in the near future. One of the measures that could ensure the normal yield of apples and pears in the coming period is the cultivation of autochthonous varieties. According to the data from the literature, autochthonous varieties are resistant to plant diseases. Apple ("Sarunka", "Sumatovka", "Kolacara", "Budimka") and pear varieties ("Vodenac", "Kaludjerka", "Lubenicarka", "Jecmenka", "Letnji kajzer" and "Karamanka") were used in the research. By using specific laboratory tests (ELISA test, IF test, Biologist test) as well as checking pathogenicity, inoculation of young apples and pears, the presence of Erwinia amylovora at autochthonous varieties will be proved. "Gloucester" apples and "William" pears were used as controls. The autochthonous varieties of apple and pear used in this study are resistant to Erwinia amylovora, although the occurrence of bacterial exudate by artificial inoculation was recorded.

Keywords: *Erwinia amylovora, apple, pear, autochthonous varieties.*

ANTIFUNGAL ACTIVITY OF ESSENTIAL OILS ON ASPERGILLUS FLAVUS ORIGINATING FROM MAIZE KERNELS

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Abstract

The application of pesticides is an actual plant protection measure in agriculture that can have adverse effects on people's health and environments. A great attention is paid to the biological fungicides. Performed studies indicate satisfactory results of activities of essential oils, which furthermore point out to possibilities of their inclusion in crop protection programs. The aim of this study was to determine antifungal, contact activity of essential oils of thyme (*Thymus vulgaris* L.) and oregano (*Origanum vulgare* L.) on toxigenic fungal species *Aspergillus flavus* causing maize kernel rot. The sterile filter paper was placed in the inner lead of Petri dish. Two, four, six, eight and 10 µl of essential oils were pipetted on the paper, and then pure *A. flavus* cultures were subcultured on PDA. After seven days in the dark at 25°C, the degree of inhibition was determined by measuring the fungal growth and their comparison to the control. The fungus, without addition of essential oils, was used as the control. The strongest antifungal activity was expressed by thyme essential oil, which already at the amount of 2 µl completely inhibited the mycelium growth. The identical effect was achieved with the amount of 4 µl. The greater amount of essential oil the more progressive growth of the fungal colony (6 µl – 3 mm; 8 µl – 9 mm). However, the mycelium growth at the amount of 10 µl of essential oil was only 1 mm. The similar results were gained with oregano essential oil (2 µl – 3 mm; 4 µl – 7 mm; 6 µl – 9 mm; 8 µl – 9 mm; 10 – 6 mm). The fungal growth of control was 30 mm. The obtained results indicate the significant potential of the application of thyme and oregano essential oils as possible natural and environmentally friendly means for the protection of maize against *A. flavus*.

Keywords: *Biological fungicides, Essential oils, Aspergillus flavus, Maize.*

EFFECT OF 1-METHYLCYCLOPROPENE ON STORAGE OF PEAR 'WILLIAMS'

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Abstract

The paper presents the influence of the use of 1-methylcyclopropene (1-MCP) on the shelf-life quality of pear fruits of the cultivar 'Williams' with two different cultivation sites in the vicinity of Čačak (Serbia). The fruits were stored separately under the same cooling conditions in a controlled atmosphere (CA) at -0.5-0.5°C after treatment. The tests were performed before the treatment of fruits, and then 1 day, 30 days and 90 days after treatment and shelf life of 7 days of aging at room temperature (20°C). The application of 1-MCP affected the preservation of fruit weight and strength at different measurement intervals. The soluble solid content and pH increase, and total acids content decreases with storage length, with smaller variations in treated compared to untreated fruits. Based on the examined parameters, the optimal storage period of fruits treated with 1-MCP from both sites was 30 days and shelf life of 7 days. The storage period of 90 days affected the biochemical parameter of the fruits and their use immediately after taking them out of the cooler. The length of fruit storage depends on the results of the initial examined parameters during the harvest, the content of macronutrients and their relationship, climatic conditions, the length of the period between harvest and treatment with 1-MCP, etc.

Key words: *1-Methylcyclopropene, Shelf-Life Quality, Pear, 'Williams'.*

INFLUENCE OF SULFUR DIOXIDE AND ASCORBIC ACID ON PHENOLIC ACIDS IN CABERNET SAUVIGNON WINE

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Abstract

Many reactions between O_2 and phenolic compounds or ascorbic acid in the wine induce an rapidly rate of consumption of O_2. If concentration of sulfur dioxide is sufficiently high in wine, the reaction products of O_2 and the wine components are mostly avoided. The impact of addition $K_2S_2O_5$ and ascorbic acid to phenolic composition in wine was investigated. Analysis of Cabernet Sauvignon wine was made by classical vinification and maceration (21 days) inoculated with pure yeast strain *Saccharomyces cerevisiae* (BDX, Lallemand, Canada). After six months of storage, in different samples of experimental wine increasing contents of $K_2S_2O_5$ (3g/hl, 5g/hl and 7g/hl) and ascorbic acid in concentration 200mg/lwere added. Control sample without any addition was the same for both of experiments. Phenolic acids in wines wereanalyzed by UPLC H-Class System.Thestatistically significant difference between control and wine samples added by 5 and 7g/hl of $K_2S_2O_5$for derivates of benzoic acidwas observed. Addition of $K_2S_2O_5$in all of added concentrations did not significantly changed content of derivates of cinnamic acids. SO_2 has an excellent abilitystabilise hydroxycinnamic acid polyphenols such as caffeic acid when exposed to conditions of oxidation. Influence of ascorbic acid wasnot statistically significant for content of benzoic and cinnamic acidsderivatesin wine. Among phenolic acids the most susceptible to oxidation are those containing an ortho-diphenol functional group, including caffeic acid and its derivatives and compounds with a triphenol group such as gallic acid.

Keywords: *Sulfur dioxide, Ascorbic acid, Phenolic compounds, Red wine.*

INFLUENCE OF REFINING PROCESS ON MYCOTOXIN CONTENT IN VEGETABLE OILS AND FATS

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Abstract

Oilseeds and crude oils may contain various contaminants that accumulate in the oil during vegetation, processing and storage of raw materials. All contaminants and their metabolites are harmful to human health. The refining process, in different stages, leads to the removal of these contaminants and they should not be found in refined oils. In addition to removing unwanted ingredients by refining, there are components of vegetable oils that need to be preserved due to their positive effect. As a result of the refining process, by-products appear to under go further processing. A special place among the contaminants is occupied by fungi (molds) that have the ability to produce mycotoxins, and the most important molds are *Aspergillus*, *Fusarium* spp., *Penicillium*, *Alternaria*. Some of the most common mycotoxins are aflatoxin, ochratoxin, fumonisins, trichothecenes, zearalenone, and patulin. The aim of this paper is to review the latest scientific knowledge, which relates to the influence of individual stages of the refining process on the content of mycotoxins in vegetable oils and fats, as well as the possibility of removing these contaminants from oils and fats during the refining process. In the production of vegetable oils and fats, the refining process is effective for reducing the content or removal of certain mycotoxins, in order to obtain quality, health-safe edible refined oil or fat. Since there are two basic refining processes, research has shown that chemical refining is, in that sense, more suitable than physical. The stages of refining during which most mycotoxins are removed are neutralization, bleaching and deodorization/dezoneutralization.

Keywords: *Edible oil, Contaminants, Mycotoxins, Removal.*

COLOR CHARACTERISTIC OF NON-REFINED OILS OBTAINED BY COLD PRESSING OF THE SEEDS OILS OBTAINED FROM CONFECTIONARY SUNFLOWER HYBRIDS

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Abstract

Most vegetable oils obtained by cold pressing are yellow or yellowish-brown, with red or green tone. The color of the oil is a consequence of the presence of colored macromolecules (pigments). The most common natural pigments in the oils are carotenoids (yellow) and chlorophylls, green color pigments. The color is also affected by the content of various non-glyceride ingredients present in the oils, but also by various products formed during the inadequate management of the technological process. The aim of this study was to examine the content of the most abundant pigments (total carotenoids and total chlorophylls) in sunflower oil obtained by cold pressing of three confectionary (non-oily) sunflower hybrids (NS-H-6318, NS-H-6307 and NS-H-6308), as well as to determine their influence on instrumentally determined color parameters (CIE *L*a *b** system and transparency). Negative *a** values noticed in examined samples indicate presence of green pigments in examined oils. Total chlorophyll content found in samples amounted from 0.41 to 0.70 mg/kg. Very strong negative correlation (R = -0.99) was determined between *a** color parameter and total chlorophyll content. On the other hand, strong correlation (R = 0.74) was noticed between yellow balance (*b**) and total carotenoids content. These compounds content amounted from 6.31 to 10.24 mg/kg. Also, very strong correlation (R = 0.90) was found between *L** color parameter indicating lightness and transparency obtained spectrophotometric..

Keywords: *Cold pressed oil, Sunflower, Pigments, CIE L*a*b*, Transparency.*

EFFICACY OF FUNGICIDES IN CONTROL OF CHERRY PATHOGEN *MONILINIA LAXA* (ADER. and RUHL.)

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Abstract

Cherry is a deficient fruit species in the world and in Serbia, where it has become the most economically viable fruit species. There has been a growing interest among agricultural producers in raising orchards and growing cherries, in recent years. During flowering, in spring, climatic conditions are convinient for the development of the pathogen *Monilinia laxa*, which causes drying of flowers, twigs, branches and fruits. In order to produce healthy food and protect the environment, it is necessary to choose the right fungicides, as well as their timely and proper application, which is not cared about a lot in the area of southeastern Serbia. The research was conducted during 2020 and 2021 on the registered agricultural farm of the municipality of Lebane in Serbia, KM (cadastral municipality) Bošnjace. The experiments were performed according to a block system with three variants. The fungicide boscalid+pyraclostrobin (Signum) was applied in the first variant and in the second - cyprodinil (Ciprodex). The third variant was control, without the application of chemical protection measures. Evaluation of the effectiveness of the tested fungicides was performed by counting infected (dried) and healthy flowers on the tested trees. A thousand flowers were counted in a variant, and samples were taken from four different sides of the tree. The effectiveness of the tested fungicides was calculated according to the Abbott formula. The efficiency of chemical measures was high in both years of research and ranged from 94.56% for the fungicide Ciprodex in 2020, to 97.69% for the fungicide Signum in 2021.

Key words: *Cherry Burlat, Monilinia laxa, efficiency, fungicides.*

MORPHOLOGICAL CHARACTERISTICS OF *EUTYPA LATA* ISOLATES FROM GRAPEVINE IN SERBIA

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Abstract

In an *in vitro* experiment, the morphological characteristics of three *Eutypa lata* isolates (EL129, EL153 and EL199), previously determined at the molecular level, and two reference isolates BX1.10 and 8F obtained from the Institute National de la Recherche Agronomique, INRA, France were observed. The following morphological features of the studied isolates were studied on the nutrient medium of potato dextrose agar (PDA): macroscopic (appearance, color and zoning of the front and back of the culture) and microscopic (vegetative organs of mycelium, reproductive organs of anamorphs - conidia, pycnidia, conidiophores and reproductive organs of teleomorphs - perithecium, ascus with ascospore). On potato dextrose medium (PDA) 24 h after placing, the studied *E. lata* isolates formed at the beginning a white mycelium. After 10 days, the mycelium had a cottony appearance, white color with a weak air growth. The entire colony developed evenly and had a fine diffuse edge. After 30 days, the face of the colony was white with a thick cotton aerial mycelium and a pale yellow conidial mass, which was excreted from the pycnidia. The studied *E. lata* isolates formed pycnidia, which were formed in culture. The pycnidia of the studied *E. lata* isolates were spherical or irregular in shape, from dark brown to black in color. The dimensions of the pycnidia were from 0.5 to 1 mm. Conidial mass was a cream to pale orange color on a PDA base. All studied isolates formed conidia in culture. None of the studied *E. lata* isolates, originating from the stem and branches of the grapevine from Serbia, as well as the control isolates, formed perithecia in culture.

Key words: *Isolates, breeding traits, substrates, Eutypa lata.*

IDENTIFICATION OF MYCOPOPULATION ON AMERICAN HIGHBUSH BLUEBERRY IN SERBIA

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Abstract

In recent decades, the American highbush blueberry (*Vaccinium corymbosum* L.) has gained an increasingly important place in the fruit production of several countries around the world, especially in the highly developed ones. Also, there is a growing interest of berry fruit producers from Serbia in growing highbush blueberry plantations. Currently, in Serbia, highbush blueberries are grown on an area of about 2,500 ha with a tendency to increase production. Blueberries are attacked by numerous diseases that can cause greater economic damage, and in exceptional cases lead to the decline of entire orchards. There have been no systematic studies of blueberry mycopopulation in Serbia so far. In this study, we present the results of preliminary research on the mycopopulation of blueberries originating from Serbia. Samples were collected in the period June-August 2020. A total of 18 samples from five sites were analyzed (Ivanjica 3, Čačak 3, Sopot 3, Bačka Topola 6 and Zlatibor 3). The developed mycelium was placed on a new PDA medium and, after the initial growth, the top part of the mycelium was placed again on PDA. Microscopic examination was performed using an Olympus CX31 microscope. Morphological identification of fungi by genus was performed using standard keys. A total of 350 plant parts were examined from which 8 genera of fungi were isolated: *Fusarium, Phomopsis* (*Diaporthe*), *Alternaria, Epicoccum, Penicillium, Ulocladium, Trichoderma* and *Pestalotiopsis*. Macroscopic symptoms of infection were clearly visible on the plants from which the fungi were isolated. Given the growing importance of blueberries as a berry fruit species, the aim of this study is to determine fungi, potential pathogens of blueberries, in order to better understand the problems (plant dieback, yield reduction, etc.) that arise as a result of fungal presence on blueberries.

Keywords: *blueberry, fungal diseases, isolation, Serbia.*

OCCURRENCE OF POWDERY MILDEW AND SEPTORIA LEAF BLOTCH IN WHEAT AFFECTED BY NITROGEN DOSE AND FOLIAR FERTILIZATION

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Abstract

Modern wheat production increasingly relies on its additional nutrition through leaves, and numerous biostimulators and water-soluble fertilizers are used for foliar feeding. This kind of nutrition regime makes plants more resistant to pathogens. During its growth wheat is attacked by many pathogenic fungi. Septoria leaf blotch (*Mycosphaerella graminicola*) and powdery mildew (*Blumeria graminis*) are the diseases occurring every year. This investigation was carried out with three wheat cultivars (Sosthene, Simonida and Evropa), during growing season 2018/2019, in the area of Gračanica municipality (K&M), on vertisol soil type. The trial was set in RCBD with four replications. The treatments were the following: 1) Control; 2) $N_{50}P_{90}K_{90}$; 3) $N_{100}P_{90}K_{90}$; 4) $N_{150}P_{90}K_{90}$; 5) $N_{100}P_{90}K_{90}$+ Agrostemin; 6) $N_{100}P_{90}K_{90}$ + Murtonik; 7) $N_{100}P_{90}K_{90}$ + Agrostemin + Murtonik. Occurrence and development of both diseases were observed, and attack intensity was graded during the first weeks of June, according to the standard scales for septoria leaf blotch and powdery mildew. Fertilization regime significantly affected occurrence and intensity of septoria leaf blotch. In cultivar Sosthene foliarly applied Agrostemin and Murtonik reduced the disease development. The treatments with those two supplements applied ($N_{100}P_{90}K_{90}$ + Agrostemin and $N_{100}P_{90}K_{90}$ + Murtonik) had the lowest infection intensity (5.0%). Powdery mildew was registered in all three studied cultivars, but not in all the treatments. Unlike septoria leaf blotch, powdery mildew occurred sporadically, and with low intensity.

Keywords: *Wheat, Septoria leaf blotch, Powdery mildew, Fertilization.*

SWEET CORN AS FUNCTIONAL FOOD

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Abstract

Sweet corn is a well-established product in the market, and popular food all around the world. It is a source of phytochemicals which, due to their antioxidant activities, demonstrate significant beneficial contribution in reducing the risk of many diseases, and therefore sweet corn could be considered as a functional food. The aim of this study was to examine phytochemicals content in four sweet corn hybrids. Carotenoids, tocopherols and phenolic acid content was determined by HPLC-DAD/FLD and functional oligosaccharide by HPAEC-PAD. The highest content of lutein + zeaxanthin was found in hybrid ZP515su (37,53 μg/g), while hybrid ZP553su had the highest content of β-carotene (1,01 μg/g). Sweet corn grains are a considerable source of phenolic acids such as ferulic, caffeic and p-coumaric acids which have a wide scope of effects against human diseases including cancer, cardiovascular and neurodegenerative diseases. The highest content of total phenolic acids was found in hybrid ZP553su (73,94 μg/g) and ferulic acid in hybrid ZP515su (26,67 μg/g). Functional oligosaccharides could bring benefit to human health and are consider as dietary fiber and prebiotics. Hybrid ZP504su had the highest content of trehalose and turanose, hybrid ZP355su maltose and panose, as well as hybrid ZP515su raffinose, isomaltose and maltotriose. As an important component of a healthy diet, sweet corn provides high nutrition value in addition to the enjoyment in taste. Therefore, developing of sweet corn genotypes with high phytochemicals content is challenge for breeders.

Key words: *sweet corn, functional sugar, phytochemicals, health benefits.*

EFFECT OF SOIL MANAGEMENT SYSTEMS ON THE GENERATIVE POTENTIAL AND FRUIT QUALITY OF BLACK CHOKEBERRY

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Abstract

This experiment evaluated the effect of soil management systems (bare soil and black foil mulch) on the generative potential (number of clusters per inflorescence, number of flowers per inflorescence, number of berries per cluster, berry set percentage, cluster weight, berry weight, yield per bush, yield per unit area) and fruit quality (soluble solids content, total sugars, total acids, pH value and protein content) in black chokeberry [*Aronia melanocarpa* (Michx.) Elliott] of cultivar 'Nero'. Significant differences in generative potential were detected among soil management systems. The experimental results showed that black foil mulch, due to its ability to increase temperature and moisture in the soil directly led to an increase in the number of clusters per inflorescence, number of flowers per inflorescence and number of berries per cluster. In contrast, bare soil, with lower soil water content and temperature stimulated an increase in the cluster weight and berry weight, as well as yields per bush and per unit area. Also, soil management systems had a significant effect on the chemical composition of the fruit. Black foil mulch promoted the synthesis of soluble solids, sugars and protein, while bare soil favoured the accumulation of acids in chokeberries. Generally, the results suggested that black chokeberry grow well under varied soil management systems, and indicated that soil management systems had a significant effect on the generative potential and fruit quality.

Keywords: *Aronia melanocarpa, bare soil, black foil mulch, generative potential, chemical fruit traits.*

MORPHOLOGICAL CHARACTERISTICS OF *EUTYPALATA* ISOLATES FROM GRAPEVINE IN SERBIA

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Abstract

In an in vitro experiment, the morphological characteristics of three *Eutypalata* isolates (EL129, EL153 and EL199), previously determined at the molecular level, and two reference isolates BX1.10 and 8F obtained from the Institute National de la Recherche Agronomique, INRA, France were observed. The following morphological features of the studied isolates were studied on the nutrient medium of potato dextrose agar (PDA): macroscopic (appearance, color and zoning of the face and back of the culture) and microscopic (vegetative organs of mycelium, reproductive organs of anamorphs - conidia, pycnidia, conidiophores and reproductive organs of teleomorphs - perithecium, ascus with ascospore). All studied isolates formed conidia in culture. None of the studied *Eutypalata* isolates, originating from the stem and branches of the grapevine from Serbia, as well as the control isolates, formed perithecia in culture.

Key words: *Isolates, breeding traits, substrates, Eutypalata.*

IDENTIFICATION OF MYCOPOPULATION ON AMERICAN HIGHBUSH BLUEBERRY IN SERBIA

Sanja ŽIVKOVIĆ[1*], Tanja VASIĆ[1], Darko JEVREMOVIĆ[2], Aleksandar LEPOSAVIĆ[2]

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Abstract

In recent decades, the American highbush blueberry (*Vaccinium corymbosum* L.) has gained an increasingly important place in the fruit production of several countries around the world, especially in the highly developed ones. Also, there is a growing interest of berry fruit producers from Serbia in growing highbush blueberry plantations. Currently, in Serbia, highbush blueberries are grown on an area of about 2,500 ha with a tendency to increase production. Blueberries are attacked by numerous diseases that can cause greater economic damage, and in exceptional cases lead to the decline of entire orchards. There have been no systematic studies of blueberry mycopopulation in Serbia so far. In this study, we present the results of preliminary research on the mycopopulation of blueberries originating from Serbia. Samples were collected in the period June-August 2020. A total of 18 samples from five sites were analyzed (Ivanjica 3, Čačak 3, Sopot 3, Bačka Topola 6 and Zlatibor 3). The developed mycelium was reseeded on a new PDA medium and, after the initial growth, the top part of the mycelium was seeded again on PDA. Microscopic examination was performed using an Olympus CX31 microscope. Morphological identification of fungi by genus was performed using standard keys. A total of 350 plant parts were examined from which 8 genera of fungi were isolated: *Fusarium, Phomopsis* (*Diaporthe*), *Alternaria, Epicoccum, Penicillium, Ulocladium, Trichoderma* and *Pestalotiopsis*. Macroscopic symptoms of infection were clearly visible on the plants from which the fungi were isolated. Given the growing importance of blueberries as a berry fruit species, the aim of this study is to determine fungi, potential pathogens of blueberries, in order to better understand the problems (plant dieback, yield reduction, etc.) that arise as a result of fungal presence on blueberries.

Keywords: *blueberry, fungal diseases, isolation, Serbia.*

COLOUR STABILITY OF CYANIDIN IN SLIGHTLY ACIDIC SOLUTION

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Abstract

Anthocyanins are the more important plant pigments visible to the human eye. They make a significant contribution to the colour, and hence acceptability, of many fruits, some vegetables and associated products, including beverages and preserves. The study of natural colourants is extensive and active area of investigation due to the growing interest of substituting synthetic colourants with toxic effects in humans with anthocyanins which possess an array of health-promoting benefits. Considering the beneficial effect for the health of these molecules, their incorporation in food and beverages industries represents an important value. Similar to other anthocyanins, cyanidin can take on various structural forms in aqueous environments, which depend on pH. To determine their stability in detail, we stored (4320 min) cyanidin in aqueous solution at pH 6.0 at room temperature (25.0 °C) and tracked the colour stability by UV–Vis spectrometry. The aim of this study was to investigate colour stability of the cyanidin in slightly acidic solutions during storage at room temperature in order to obtain more precise information to evaluate the possibility of its use as a food colour. Cyanidin colour stability in the first three hours after dissolution was high. However, after three days of storage, colour stability was decreased to half and the colour of the solution changed. The use of anthocyanins like cyanidin as food colourants in slightly acidic products should therefore be considered at least in products with limited storage.

Keywords: *cyanidin, anthocyanins, colour stability, UV–Vis spectrometry.*

INFLUENCE OF DIFFERENT DENSITIES DURING SOWING ON BUCKWHEAT (*FAGOPIRUM ESCULENTUM* L.) YIELD AS A SUBSEQUENT IN AGRICULTURE

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Abstract

Buckwheat is a very old culture native to Asia. It does not show great demand for the soil, it can be grown on slightly acidic soil (up to pH 5.5), but it requires a more humid climate (with more precipitation) because it is quite sensitive to drought and high temperatures, especially during flowering and pouring grain. Sowing is done when the soil is heated to about 15 °C. Sowing can start from 01.05. to 15.05. when there is no danger of frost. The density of the assembly is about 200-250 germinating seeds per m^2. An experiment with 12 different buckwheat populations was set up on the PSS "Sombor" experimental field. Three experiments were set up with the same row spacing of 25 cm, while the row spacing on the first variant was 5.0 cm, on the second 3.75 cm and on the third variant 2.5 cm. During the experiment, the condition of the crops was monitored, as well as the yields after the harvest, which clearly showed that when using buckwheat as a side crop, we had to go for a denser sowing (2.5 cm). Due to relatively low yields (about 2 t/ha), the production of buckwheat as the main crop in Vojvodina is less profitable. Buckwheat is a very competitive plant with weeds due to its rapid germination and strong initial growth, so it quickly over shadows the surface, and thusthus sprouted weeds. That is why it is good to sow it as a functional food, and if necessary for green manure.

Keywords: *agriculture, subsequent, research, experiment, population.*

POD DAMAGE MONITORING IN OILSEED RAPE IN VOJVODINA

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Abstract

The cabbage seedpod weevil (*Ceutorhynchus assimilis* Paykull) and the brassica pod midge (*Dasineura brassicae* Winnertz) are the most important pod pests of oilseed rape worldwide. Their occurrence as well as the damage they cause can vary depending on the locality and season. They cause damage by feeding on pieces of pods which can result in pod shattering. The monitoring of the cabbage seedpod weevil and the brassica pod midge was conducted during a five-year period, from 2015 to 2019, according to EPPO standards. The aim of the monitoring was to assess the damage potential of these two species and to determine whether chemical control is economically justified. The pods were taken from oilseed rape fields under different agro-climatic conditions and plant protection regimes and number of larvae were counted. The number of examined pods varied from 1600, in 2018, to 7700 in 2017. The lowest average presence of brassica pod midge larvae in pods was recorded in 2015, 1,87%, while the highest in 2018, 4,62%. The number of pods containing the cabbage seedpod weevil was much lower and varied between 0 in 2015 to 0,64% in 2016. The maximum number of the cabbage seedpod weevil larvae per pod was one while for the brassica pod midge it was 116. The results showed that both species currently are not economically important for oilseed rape production in Vojvodina province. *D. brassicae* and *C. assimilis* should be monitored continuously in Serbia in order to prevent any possible economically significant damage in the future.

Key words: *cabbage seedpod weevil, brassica pod midge, oilseed rape.*

EFFECT OF A BIOSURFACTANT EXTRACTED FROM CORN STEEP LIQUOR ON THE UPTAKE OF COPPER OXYCHLORIDE BY *BOTRYTIS CINEREA* CELLS

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Abstract

EU regulations have been introduced in the last few years regarding the use of ecofriendlier pesticides by reducing the amount of certain compounds that are harmful for the environment in their formulations. Among them, copper-based pesticides are ones of the most commonly used, especially copper oxychloride (Cu-Oxy), for the treatment of crops against pests. However, these active principles need high concentrations of emulsifying agents due to their poor solubility in water. Biosurfactants are surface-active compounds that are obtained by microbial production and are used as emulsifiers due to their capacity to reduce the surface tension of water. In a recent study, a biosurfactant obtained from a residual stream from the corn-milling industry, corn steep liquor (CSL), showed a high capacity of solubilization of Cu-Oxy in water. In addition, this biosurfactant showed antimicrobial activity against different microorganisms, being interesting its incorporation in formulations of pesticides. Therefore, in this work the effect of a biosurfactant extracted from CSL was assessed in combination with Cu-Oxysolutions on a crop pathogenic fungal strain, *Botrytis cinerea*. The results showed that higher amounts of copper were bioaccumulated in the biomass after 5 days of incubation in presence of the biosurfactant, in comparison with experiments inabsence of it. Based on these results, it can be concluded that biosurfactants from CSL improve the uptake of Cu-Oxy by *B. cinerea* cells. Therefore, this biosurfactant could play an important role inthe formulation of ecofriendlier pesticides, reducing the concentration of harmful active principles.

Keywords: *corn steep liquor, biosurfactant, copper oxychloride, Botrytis cinerea, pesticides.*

EFFECTS OF SOME INSECTICIDES ON THREE INSECT PREDATORS IN THE SUDAN

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Abstract

A small scale field experiment in Sudan, Africa, was conducted in this study to test the effects of four insecticides, Talstar 10% EC (bifenthrin) at 15 g a.i./feddan (=4200 m^2), Metasystox R 25 (oxydemeton [oxydemeton-methyl]) at 226.25 g a.i./feddan, Marshal 25% EC (carbosulfan) at at 200 g a.i./feddan, and Polo 50 SC (diafenthiuron) at 126 g a.i./feddan, on three predators. A standard treatment (Reldan [chlorpyrifos-methyl] + endosulfan) and an untreated control were included in the tests. The numbers of three predators in the adult stage were assessed before and at different intervals after application. These included predatory bugs, *Campylomma nicolasi* (Hemiptera: Miridae), predatory beetles, *Cheilomenes propinqua vicina* (Coeleoptera: Coccinellidae), and spiders, caught using a sweep-net. The results of the experiment indicated that Talstar, Metasystox and the standard treatment (Reldan + endosulfan) caused a pronounced knockdown effect on predatory bugs two days after the second application. However, the population of the predatory bug recovered quickly in plots treated with Talstar and to a lower extent in those treated with Reldan + endosulfan. The effect of Metasystox persisted for a longer period on the bugs. The initial knockdown was greater after treating the coccinellid beetle with Talstar, Marshal, Metasystox and the mixture Reldan + endosulfan. Polo was not toxic to the beetle in this experiment. Spider numbers caught during the experiment were too low to allow scientific answers.

Key words: *insecticides, predators, Sudan, bugs, coccinellid.*

EVALUATION OF PSEUDOMONAS AND RHIZOBIACEAE SPP. INOCULATION ON THE GROWTH AND NODULATION OF THE HYACINTH BEAN (*LABLAB PURPUREUS*)

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Abstract

If chemical fertilizers allowed a radical increase in crop yields, their intensive use also resulted in environmental problems. The search for more sustainable solutions is essential. Legumes in the Fabaceae family develop a symbiotic relationship with bacteria of the Rhizobiaceae family and form underground organs called nodules. Bacteria from the nodules fix atmospheric nitrogen under a form assimilable by plants. Additionally some *Pseudomonas* species secrete metabolites, which promote the formation of nodules. The hyacinth bean or lablab (*Lablab purpureus*), a tropical legume, is emerging in France and Switzerland. Though part of the human diet in Africa and Asia, it is used in Europe in mixed cultures as a fodder crop, expecting an increase in forage protein content. Nevertheless, in the absence of compatible Rhizobacteria in European soils, its development remains limited because of disappointing results in terms of growth and forage protein content. Prospecting compatible symbiotic bacteria would be a solution. In this study, on lablab var. Rongaï, we tested three Rhizobiaceae strains and four *Pseudomonas* spp. strains obtained from lablab nodules on local soils, alone or in combination. The bacterium *Sinorhizobium fredii* strain NGR 234 was efficient to form nodules with lablab, alone and in combination with *Pseudomonas* spp. resulting in significantly higher fresh and dry yield of aerial parts and higher chlorophyll content. The co-inoculation of *Sinorhizobium fredii* and *Pseudomonas putida* strain LB10 yielded even better results. Another strain *Pseudomonas* LB5, when inoculated alone, favoured the lablab growth (higher dry weight and chlorophyll content), without forming any nodules.

Keywords: *Pseudomonas, Rhizobiaceae, nodulation, hyacinth bean, Lablab purpureus.*

MICROBIOLOGICAL CONTROL OF *VARROA DESTRUCTOR*: EFFICACY ASSAYS OF ENTOMOPATHOGENIC FUNGI

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Abstract

Honeybees are insects essential to the life cycle of many entomophilic plants providing 30% of total pollination. Following the first decline of wild colonies of *Apis mellifera* in the 1970s attributed to the parasitic mite, *Varroa destructor*, a second wave of decline, described as Collapse Colony Disorder (CCD), touched the honeybee colonies from the 1990s. Pesticides, pathogens and parasites or the reduction of quantity and diversity of food resources mainly cause this syndrome, with *V. destructor* identified as the major factor. Chemical products used today remain unsatisfying for its control and alternative solutions are needed. In a first work, entomopathogenic fungi were isolated from corpses of varroas or from soil and found able to develop optimally under hive conditions. In the present work, we developed an original method for collecting live varroas from the beehive using a trapping frame. The varroa maintenance system (VMS) then allowed keeping varroas alive on bee pupaefor seven days experiments, during which varroas were exposed to conidia or sterile filtrates from liquid fungi cultures. Observations were made daily. Twelve fungal 26 strains were tested and four strains, *Paecilomyces* sp. 24.1 UASWS1451, *Metarhizium anisopliae* 32.1 UASWS1461, *Metarhizium anisopliae* 33.1 UASWS1462 and *Metarhizium anisopliae* 34.2 UASWS1468 yielded an average mortality rate of the mites of 97.4% seven days after treatment with conidia. Additionally, *Penicillium sp.* 55A induced 53.3% mortality of varroas seven days after treatment. Noticeably, these strains did not affect bee pupae development. These promising results are being repeated a second year.

Keywords: *Varroa destructor, Apis mellifera, entomopathogenic fungi*.

MICROBIOLOGICAL CONTROL OF *VARROA DESTRUCTOR*: SELECTION AND EVALUATION OF POTENTIALLY ENTOMOPATHOGENIC MICROORGANISMS

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Abstract

Honeybees are essential insects to many entomophilic plants and provide 30% of total pollination, playing a key-role in maintaining ecosystems and agrosystems. In Europe, the first decline in wild colonies of *Apis mellifera* from the 1970s was attributed to the parasitic mite, *Varroa destructor,* which weakens colonies until collapse. Then, between 1990 and 2010, a second decline occurred, described as Collapse Colony Disorder (CCD), originating from multiple synergistic factors, mainly pesticides, pathogens and parasites, reduction of quantity and diversity of food resources. *V. destructor* being a major cause of CCD. Control attempts are active all over the world, but products usedare not without risk for beekeepers and colonies. They also impact bees and are found as residues in the hive. Furthermore, varroas became resistant to synthetic molecules. The need for alternative solutions is, therefore, acute. We developed here a reliable protocol to isolatepotential entomopathogenic fungi and bacteria, from Varroa mites' corpses, which were collected from beehives in Geneva, with the method of monitoring natural mites drop. They were superficially disinfected and placed on selective culture media. This yielded 91 fungal and 16 bacterial isolates, which were genetically identified. Their growth optima according to the conditions of the hives (30°C and 35°C) were also sought for this collection and 21 other entomopathogenic fungal strains from our lab. Five fungal strains of our lab collection systematically met these growth conditions requirements. Furthermore, 21 *Penicillium* spp. strains and all bacterial strains from varroas were able to grow in these conditions.

Keywords: *Varroa destructor, Apis mellifera, entomopathogenic fungi, entomopathogenic bacteria.*

LINKING RESPONSE TO SHADE WITH GROWTH AND YIELD IN SEVERAL COFFEE AGROFORESTRY SYSTEMS IN ECUADORIAN AMAZONIA

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Abstract

We assessed how agroforestry shade cover, shade types and farming practices affected Coffea canephora (robusta) growth, physiology and yield in a five years old experimental coffee plantation in Ecuadorian Amazonia. We hypothesized that shade would increase chlorophyll concentrations, further enhanced by nitrogen-fixing trees and would consequently increase yields. The experiment was planted in 2015 and five treatments were 1) full sun; 2) Myroxylon balsamum; or two N-fixing trees 3) Inga edulis; 4) Erythrina sp. or 5) Erythrina sp. plus M. balsamum. Four farming practices assessed were: conventional farming at either 1) moderate or 2) intensified input and organic farming at 3) low or 4) intensified input. The experiment was a randomized complete block design with 20 treatment combinations, replicated three times. Shade cover above coffee was assessed with an MP-200 pyranometer on four coffee plants for each zone. Two chlorophyll measurements were made per leaf and four leaves per branch in two pairs of leaves at the middle third of the branch with an MP-100 chlorophyll meter. One branch was measured per plant, which resulted in eight measures per plant on 18 plants per plot. Berry yields under moderate shade level were similar to those under full sun exposure. Coffee trees were, on average, taller under the N-fixers (+10%), Inga edulis and Erythrina, than in either the full sun control or under other treatments. No correlation was found between height, early cherry yield and chlorophyll content. Nevertheless, shade provided by N-fixing trees leads to higher leaf chlorophyll content (+ 22%).

Keywords: *Coffea canephora, Myroxylon balsamum, Inga edulis, Erythrina spp., M. balsamum.*

EVALUATION OF BACTERIAL BIOSTIMULANTS ON THE GROWTH AND FLOWER PRODUCTION OF *CANNABIS SATIVA* L.

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Abstract

Thirty bacterial strains, isolated from soils or endophytes to diverse plant species, belonging to the genera *Bacillus, Pseudomonas, Paenibacillus* and *Kokuria* were tested by inoculating potted hemp (*Cannabis sativa* L) indoors cultures of the cannabidiol (CBD) variety Silver Haze V1, over a four -week growth period, for selecting the best candidates in terms of growth. Parameters measured were chlorophyll content, crown diameter, shoot fresh and dry weights and internodes lengths. After this first selection round, five bacterial strains were retained for assessing their effect on growth, flower yield and cannabinoids contents of hemp over a 12-week growth period until flowering and harvest. These strains were *Paenibacillus* sp. GDS96 UASWS1643, *Bacillus aryabhattai* B29 UASWS1812, *Bacillus simplex* B33 UASWS1816, *Bacillus amyloliquefaciens* BA5 UASWS1607 and *Pseudomonas koreensis* UASWS1668. Inoculations of *Paenibacillus* sp. GDS96 UASWS1643, *Bacillus aryabhattai* B29 UASWS1812 and *Bacillus amyloliquefaciens* BA5 UASWS1607 expressed biostimulant properties measured as statistically significant increase (11-18%) in crown diameter, when compared to non-fertilised plants. *Paenibacillus* sp. GDS96 UASWS1643 even induced 14.5% increase in crown diameter, if compared to the positive fertilized control. *Paenibacillus sp*. GDS96 UASWS1643, *Bacillus amyloliquefaciens* BA5 UASWS1607 and *Bacillus simplex* B33 UASWS1816 induced higher chlorophyll contents. In terms of increase in dry flowers yields, all inoculations produced more dry flowers weight than the negative control, but *Paenibacillus sp*. GDS96 UASWS1643 and *Bacillus aryabhattai* B29 UASWS1812 yielded very significant effects: 20.6% and 24.7 % more flowers weight than the negative control and 8.5% and 12.5% more than the positive control. They also yielded more C content.

Keywords: *Bacillus aryabhattai, Bacillus amyloliquefaciens, biostimulants, Cannabis sativa L., Paenibacillus sp.*

AGROECOLOGICAL PROPOSALS FOR ORGANIC VEGETABLE PRODUCTIONS AT A SMALL FARM IN GENEVA

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Abstract

This work proposes agroecological solutions for the vegetable organic production of an organic farm in Geneva. A new operational index, the Crop Performance Index (CPI), was created and applied as a tool to motivate choices in crop rotations. This index evaluates the ratio between the quantity of nitrogen fertilizer absorbed by the plants and the fresh saleable material produced from these plants, while taking into account in the meantime the market costs of fertilizers and the retailable products prices. The CPI identifies the vegetables that produce the most important production turnover per square meter with the least amount of nitrogen fertilizer. Other fertilizers may be incorporated to the formula to give a more complete picture of crops performances. By integrating the CPI, a new cropping plan and a new rotation plan were developed to increase the farm's turnover while respecting the agroecological principles. The aims were to predominantly incorporate species adapted to the soil and climate conditionsto the cropping plan, to diversify genetic resources and to optimize the energy flows within the system. Subsequently, the fertilization plan of the farm was analysed and proposals of adaptation were made based on the CPI. Composting techniques were described and a new manuring plan for the farm was established integrating a vermicompost set-up to turn farm wastes into farm resources. The metabolites excreted by the microflora of the digestive tract of earth worms were recovered to trace the nitrate content. The foundations for the elaboration of a new agroecological fertilizer were established.

Keywords: *agroecology, organic agriculture, crop performance index.*

FIRST RECORD OF CIRCULAR LEAF-MINER LEUCOPTERA SCITELLA ZELL. ON SEVERAL HOSTS IN SYRIA

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Abstract

The study was carried out in Al- Quneitra and Rif Dimashq governorates during 2018 and 2019, where the circular leaf-miner *Leucoptera scitella* Zell (Lepidoptera: Lyonetiidae) was recorded for the first time in Syria on several fruit trees hosts of Pome fruits (apples, pears and quince) and Stone fruits (peaches and cherries) of Rosaceae. The damage symptoms and different insect stages were morphologically described, and classified by specialized classification keys. The most important biometric measurements were recorded for the different insect stages, so the average body length for young larval instars (L1 and L2) was 2.05± 0.216 mm, and for large larval instars (L3 and L4) 3.72± 0.283 mm. The average length of the pupa was 3.88 ± 0.367 mm, while the average the entire length of adult female is 2.87±0.206 mm, and adult male 2.05 ± 0.150 mm. The results also showed that the beginning of appearanceof insects on apple and pear hosts was in May by 14.2 and 6.57%, respectively, and on peach and quince hosts in July by 4.29 and 3.14%, respectively. Cherry host recorded the beginning of appearance of the insect in August, by a percentage 12.57% in 2019. The highest infestation rate for the insect was 97.29% on apple host in November, which significantly outperformed rest of the hosts (pears, peaches, cherries and quince) which infestation rate was 86.57, 31.86, 23.43 and 22.71% respectively. All the differences in the mean infection percentage were significant, except for the difference between cherry and quince hosts, no significant differences were observed at a significance level of 5%. When comparing insect infestation percentage to registered hosts during the months, it was found that November was significantly superior to the rest of the months and for all hosts, followed by October, while the lowest percentage of insect infestation was on all registered hosts in May.

Key words: *First record, circular leaf-miner, Leucoptera scitella, Leafminer, different hosts, Syria.*

FIRST RECORD OF THE GENUS *GLYPTAPANTELES* ASHMEAD, 1904 (BRACONIDAE:MICROGASTRINAE) ON LARVAE OF TOMATO LEAF MINER *TUTA ABSOLUTE* (MEYRICK, 1917) IN SYRIA

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Abstract

We report the discovery of the parasitic wasp, genus *Glyptapanteles* (Braconidae: Microgastrinae), primary parasitoid of tomato leaf miner *Tuta absoluta* (Meyrick, 1917) (Lepidoptera: Gelechiidae) from Syria. It is the first record of *genus Glyptapanteles sp.* in Syria, and it is the first record of *T. absoluta* as a host of genus *Glyptapanteles*. This new genus was found in March/2021 from Syria, Lattakia province, Al-Sanobar, 35° 53′ 12″ N, 35° 28′ 31″ E. The samples of infested tomato plants were collected from a greenhouse. The parasitoid larvae were placed in glass tubes until the emergence of adult parasitoid. Parasitoid adult specimens were mounted in Canada Balsam. Images were taken with a stereomicroscope equipped with a computer-attached camera.

Key words: *parasitoid, tomato, leaf miner.*

BIOPROTECTION OF CUCUMIS MELO FROM *ALTERNARIA* LEAF SPOT BY *GLOMUS MOSSEAE* AND *TRICHODERMA HARZIANUM*

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Abstract

Alternaria alternata, responsible for leaf spot disease, is a worldwide spread notably in Iraq. This disease is characterized by the formation of lesion on the leaves, leading to substantial yield and quality losses in *Cucumis melo* (melon). *Glomus mosseae* and *Trichoderma harzianum* are considered to be an eco-friendly and bio-safe alternative to traditional chemical fungicides due to their intrinsic ability to induce native anti-stress pathways in plants. This research study was conducted to evaluate the efficacy of the tested bio-agents, *G. mosseae* and *T. harzianum* (in combination or separately), on cucumber infected with *A. alternata* under greenhouse conditions. *G. mosseae* and *T. harzianum* provided strong inhibitory effects against leaf spot disease, decreasing disease severity index (DSI = 31.35 and 40.39%, respectively) and disease index (DI = 1.30 and 1.49, respectively). Obtained results revealed that the separate treatment of melon against this airborne pathogen using *G. mosseae* and *T. harzianum* generated the strongest activity of catalase (CAT = 5.678 and 3.389 units/mg protein/min, respectively) and peroxidase (POX = 9.948 and 7.542 units/g/ml/min, respectively). However, the ongoing results revealed that the combination of *G. mosseae* and *T. harzianum* negligibly reduced DSI (47.04%) and DI (2.08), and increased CAT (1.962 units/mg protein/min) and POX (3.08 units/g/ml/min) activities. To control *A. alternata* within integrated pest management strategies, biological control agents (such as *G. mosseae* and *T. harzianum*) should be taken in consideration.

Keywords: *Alternaria alternata, Cucumis melo, Glomus mosseae, Trichoderma harzianum.*

EFFICACY OF FUNGICIDES FOR CONTROL OF POWDERY MILDEW ON GRAPEVINES IN CHOTT SIDI ABDEL SALAM OASIS, TUNISIA

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Abstract

Grapevine is an important fruit crop in the Chott Sidi Abdel Salam oasis in southeastern Tunisia with good nutritional value and is consumed fresh or processed into raisins. The cultivation of grapevine provides great economic potential for the oasis population due to its higher yield and monetary returns. Powdery mildew represents one of the most destructive diseases affecting viticulture, especially in temperate-humid climate. It is an economically important fungal disease in the grapevine farms. This pathogen is able to differentially attack leaves and grapes, and is currently controlled with repeated applications of fungicides. This research aimed at employing chemical control with the objective of evaluating the capacity of contact (Talendo® (Proquinazid 200 g/L)), systemic (Pristine WG (boscalid 25.2% + pyraclostrobin 12.8%)) and a combination of both contact and systemic (Vectra 10 SC (bromuconazole 100 g/L)) fungicides at three different sampling moments (7, 14 and 21 days after the first fungicide application (DAFA)) for the control of powdery mildew of grapevines (cv. Bazzoul Kalba) under field conditions. The experiments were conducted in the oasis of Chott Sidi Abdel Salam in southeastern Tunisia. Both Pristine WG and Vectra 10 SC allowed controlling the disease intensity of powdery mildew compared to Talendo® showing a highly significant reduction of the disease incidence (26.89% and 23.06%, respectively at 21 DAFA) and the percentage of leaf area covered with powdery mildew (14.80% and 10.40%, respectively at 21 DAFA). This information can be used to help grapevines growers to improve powdery mildew control and enhance marketable yields.

Keywords: *Fungicides, Grapevines, Oasis, Powdery mildew, Tunisia.*

ISOLATION AND IDENTIFICATION OF ARBUSCULAR MYCORRHIZAL FUNGI ASSOCIATED WITH *ZEA MAYS* L. IN THE SYRIAN COAST

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Abstract

Arbuscular mycorrhizal fungi establish symbiotic associations with most terrestrial plants. The objective of this study was to identify some species of mycorrhizal fungi existing with *Zea mays* roots in the Syrian coast. Samples were collected from four sites in two different regions; Lattakia (sites: Alhandi and Fidio) and Tartous (sites: Mayaar Shaker and Hrysoon). Four samples of soil and *Z. mays* roots were collected from each site and mixed together to form a composite sample/site. Morphological characterization of isolated fungi was based on universally adopted taxonomic keys and the classification keys approved by the plant protection Research Institute of Iran. Three genera of mycorrhizal fungi were identified. *Glomus* was detected from all sitessample,. While, *Septoglomus* was isolated from two sites (Mayaar Shaker and Hrysoon), followed by *Paraglomus* (from one site (Alhandi)). Moreover, *Glomus* spp. (40%) and *Paraglomus* spp. (37%) were more frequent. The future challenge of integrated pest management against plant pathology in agricultural practices will be to improve the combinations of crop plant-arbuscular mycorrhizal fungi. This concept fits perfectly into the agricultural sustainability that can be enhanced through the promotion of soil biodiversity and targeted management of soil community composition.

Key words: *Mycorrhiza, Zea mays, Syrian coast*.

THE BLACK PARLATORIA SCALE *PARLATORIA ZIZIPHI* (LUCAS, 1853) (HEMIPTERA: COCCOMPORHA: DIASPIDIDAE): BIOLOGY, CONTROL OPTIONS AND PEST MANAGEMENT APPROACH.

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Abstract

The Black Parlatoria Scale (BPS) *Parlatoria ziziphi* (Lucas, 1853) (Hemiptera: Coccomporha: Diaspididae) is an invasive notorious scale insect species that affects citrus crops, notably in the southern Mediterranean basin. No approach to an Integrated Pest Management (IPM) strategy has currently been adopted for BPS control in the newly invaded citrus regions (Algeria, Egypt, and Tunisia). Our research aims to elucidate the pest management rules of the BPS in citrus orchards through a comprehensive study on the pest, exploring the bio-ecological environment and the life cycle stages in relation to the available control tools. The distinct life history dynamic of the BPS and the control measures, as reported in several citrus-growing countries, were critically reviewed. Eventually, interactions between the application of agro-chemicals and the life cycle stages were also revealed. Control timing is highly crucial for the BPS, since treatment methods vary significantly for each stage (feeding, moulting, dormant, reproducing, protected, producing wax) and its biological discreteness (generation overlapping, protected forms, high survival). Appropriate treatment must be timed to coincide with BPS population peaks, targeting the first crawler generation at their settlements and precisely before migration to fruits. A life cycle stage-based control model for the BPS is established to outline the future research directions of an integrated control program in the newly invaded citrus regions. Complementary studies on ecological and biological aspects of the insect population are required in the invaded citrus areas.

Key words: *P. ziziphi, citrus, overview, chemical control, management approach.*

PEST STATUS OF THE BLACK PARLATORIA SCALE *PARLATORIA ZIZIPHI* (LUCAS, 1853) (HEMIPTERA: COCCOMPORHA: DIASPIDIDAE)

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Abstract

The Black Parlatoria Scale (BPS) *Parlatoria ziziphi* (Lucas, 1853) (Hemiptera: Coccomporha: Diaspididae) is a serious citrus pest, and has the potential for establishment and spread, and for economic consequences in the citrus growing areas. Pest status dynamic and spread history of the scale insect are reviewed. The incidence of *P. ziziphi* is usually associated with host plant, climate and control programs adopted by national authorities. BPS was not a key insect pest of citrus in many countries until the 1970s. The pest has been established on citrus as primary host in Asiatic areas (China, Iran and Taiwan) and then has spread within the crop expansion to different areas through the trade movement of citrus plant materials, showing a high adaptation to different climates mainly to tropical and Mediterranean regions. The pest is established where citrus is grown, in more than 90 countries across four continents. Nowadays, severe outbreaks of the pest are reported in the southern Mediterranean countries (Algeria, Egypt, France, Italy, Spain, and Tunisia), reaching major pest status. Pest impact is more noticeable in North Africa which has recorded complicated control status. Potential future research lines should be delineated for BPS control in the newly invaded citrus areas. An integrated management approach should be developed and accurately applied in citrus orchards, focusing on monitoring techniques and biological control. Bio-control, in conjunction with other IPM components and regular monitoring, will provide sustainable control of the BPS in the newly infested citrus regions.

Key words: *P. ziziphi, citrus, distribution, Mediterranean countries.*

INFLUENCE OF ROASTED AND UNROASTED TREATMENTS ON THE FUNCTIONAL PROPERTIES OF WHOLE DURUM WHEAT HARVESTED UNDER TWO TILLAGE SYSTEMS

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Abstract

The roasting procedure is a treatment that is applied to prepare traditional meals such as *Bsissa* or *gofio*. It is known to improve the sensory quality and modify the nutritional properties. In our study, we investigated the effect of roasted (120s at 180°C) and unroasted as well as tillage system (no-tillage and conventional tillage) on the functional properties (oil absorption capacity (OAC), Water absorption capacity (WAC) and gel flour proprieties (water absorption index (WAI), water stability index (WSI) and spelling power (SP)) of durum wheat flour "*Carioca*". Results showed that the roasting treatment significantly decreased OAC (125% vs 108%), WAC (117%vs 1.14%), WAI (8.17 g/g dmvs 6.53g/g dm) and SP (11.11 g/g dm vs 8.24g/g dm), but had no effect on WSI. On the other hand, the tillage system had no effect on the functional properties of durum wheat flour. The correlation between the dependent variables indicates a strong positive correlation between SP and WAI (0.92) and with WSI (0.813), but a weak correlation between OAC and WSI (0.248).

Keywords: *Roasting, durum wheat, functional properties, no-tillage.*

BIOCONTROL OF *RHIZOCTONIA SOLANI* USING VOLATILE ORGANIC COMPOUNDS OF SOLANACEAE SEED-BORNE ENDOPHYTIC BACTERIA

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Abstract

This study prospected the use of bacterial volatile organic compounds (VOCs) to control the fungal pathogen *Rhizoctonia solani* on tomato seedlings and fruit in order to search for an alternative to chemical pesticides. Seed-born bacterial endophytes were isolated from *Solanum lycopersicum* and *S. linnaeanum* species. At early seedling stage most of the endophytic bacteria colonize the cotyledons in comparison to stems and roots. Overall, 51 % and 11 % of isolated endophytic bacteria produced antifungal VOCs against *R. solani* at 7 d and 14 d of dual culture, respectively. About 78 % of the antagonistic bacterial endophytes showed promoting activity on tomato seedling growth. For the bioprotection tests the strains TRC7 and TRC10 of *Bacillus subtilis* and TRT11 of *B. megaterium* were selected as the most antagonistic and PGP endophytic bacteria and a non-antagonistic strain SMLR7 of *Paenibacillus* sp. The TRC7 VOCs showed the best pattern of decrease of *R. solani* rotting on tomato fruit, and increased the hypocotyl length, the radicle length, the fresh weight, and the vigor of tomato seedlings. The identification of the VOCs produced by the antagonistic *Bacillus* strains showed a core set of four compounds i.e. 2-Heptanone; Pyrazine, 2,5-dimethyl-; Naphthalene; and Benzenamine, N-ethyl- which was the most abundant. All the four VOCs showed antifungal activity against *R. solani in vitro* growth. The Benzenamine, N-ethyl- showed the best antifungal activity with an IC50 about 0.09 mL L^{-1} headspace and proved to be effective in reducing *R. solani* rotting on tomato fruit at the same concentration. So, this work provides evidence about VOCs-mediated biocontrol ability of *Bacillus* strains to reduce *R. solani* seedling damping-off and fruit rot of tomato making them valuable agents for pre- and postharvest control of this disease.

Key words: *Antifungal activity, Plant growth promotion, Seed-borne endophytic bacteria, Tomato fruit rot, Volatile organic compounds.*

LONG-TERM EFFECT OF NEMATICIDAL (ETHOPROPHOS) AND BIOLOGICAL (NOVIBIO) TREATMENTS ON SOIL MICROORGANISM BALANCE

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Abstract

Long-term effects on soil microorganisms' development, within *Meloidogyne* spp. biocenosis were assessed after four successive years following nematicide (Ethoprophos) and biological product (NoviBio) treatments, applied respectively at 10g and 10 ml per m². Long-term effects of each treatment was evaluated on the soil biocenosis, associated to tomato monoculture grown under unheated greenhouse, naturally infested with *Meloidogyne javanica*. The estimated potential soil infestation of the experimental plots showed that Ethoprophos increased significantly *Meloidogyne* infestation in chemically treated plots comparatively to untreated control. Conversely, NoviBio contributed to reduce significantly soil infestation, which remained below the threshold level of tomato crop infested with root knot nematodes. The calculated ratios (Pf/Pe) of *Meloidogyne* numbers, estimated during cultivation (Pe) and after the harvesting end (Pf) were significantly different according to treatments. The potential infestation ratios were respectively 12.7, 214.5 and 753.2 for NoviBio, untreated control and Ethoprophos. The statistical analysis of the overall collected data, during the current experiment, showed that long-term side-effects of treatments were significantly different, except for bacterial populations and soilborne fungi (*Fusarium*, *Alternaria*, *Verticillium* and *Penicillium*), which showed inconsistent higher variability. Biocenosis disturbance of the treated soil was higher following Ethoprophos treatment, comparatively to NoviBio et untreated control. The relative frequency of each microorganism counted in the sampled soil has been discussed according to the treatments and compared to untreated biocenosis. .

Keywords: *NoviBio, Ethoprophos, Meloidogyne, tomato under greenhouse shelters.*

ON FARM TRIALS CONFIRMING NOVIBIO EFFICACY COMPARED WITH VYDATE ON TOMATO INFESTED BY MELOIDOGYNE JAVANICA

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Abstract

NoviBio has been compared to one- and multi-applications of the Vydate (including 250 grams of Oxamyl per liter) applied on continuous cropping tomato. Only NoviBio treatment allowed tomato production augmentation, compared with both solarized untreated control and Vydate treatments, applied under greenhouse infested with Meloidogyne (average galling index > 2). NoviBio efficacy was significantly related to nematode population reduction. NoviBio efficiency was discussed according toapparent concentration of the active ingredientof the tested commercial product.

Keywords: *NoviBio, Vydate, Meloidogyne javanica, tomato under greenhouse.*

OPTIMIZATION AND VALIDATION OF MULTI-RESIDUE LC-MSMS METHOD FOR THE ANALYSIS OF PESTICIDES IN CHESNUST

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Abstract

Chestnut is a nutritious edible fruit, which contains considerable amounts of proteins, essential fatty acids, fibers, saccharides, vitamins, and minerals. These characteristics increase its use in diets, as well as in cake and confectionary industries. Chestnut is a valuable agricultural product and the major producers are China, Spain, Bolivia and Turkey. *Cydia splendana*, *Curculio elephas*, *Septoria pistaciae*, *Gnomonia leptostyla* and *Cryhonectria parasitica* are the well-known pests and diseases of chestnut. The use of pesticides for the control of these pests and diseases is a common practice, but there is scarce information and data related with the residual analysis methods and evaluation. This study was conducted to develop and optimize a multi-residue pesticide analysis method for 310 substances in accordance with the SANTE/12682/2019 regulation using LC-MSMS due to evaluation of the pesticide residue risk level. The extraction of pesticide residues from chestnut was performed with QUECHERS method. Calibration curves prepared at concentrations between 0.05 to 2.5 mg L^{-1} showed sufficient linearity ($R^2 \geq 0.99$) within the mentioned range of ± 20%. The LODs were calculated as 5.03 µg kg^{-1} to 6.49 µg kg^{-1} while LOQs were 5.09 µg kg^{-1} to 9.95 µg kg^{-1} for all tested pesticides. Both limits were below the EU MRLs of analysed pesticides. The recovery ratios and RDS values of repeatability and reproducibility were calculated between 72.3 – 118.5%, 0.25 - 16.48% and 0.03 - 0.38%, respectively. A validated multi-residue method was developed for 310 pesticides according to SANTE/12682/2019 regulation in this study.

Keywords: *analysis, chestnut, pest management, pesticide, residue, validation.*

DETERMINATION OF ANTIFUNGAL ACTIVITIES OF WOOD VINEGAR OBTAINED FROM ECALYPTUS AGAINST TOMATO ROOT-ROT AND WILT DISEASE AGENTS

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Abstract

Root rot and wilt, caused by the several soil-borne fungal species,are a destructive and widespread tomato diseases. Although synthetic fungicides have been used to protect plants against soil borne fungal pathogens they possess adverse negative effect to human health and the environment. Looking for alternative options for controlling soil-borne disease agents, recent studies have focused on use of natural substances such as wood vinegar. Wood vinegar (also known as pyroligneous acid or pyrolysis oil), a co-product of the thermal decomposition of biomass in an oxygen-starved environment (pyrolysis), improve soil quality, plant growth, and is shown to have antimicrobial properties. Antifungal activities of different concentrations of wood vinegar (2.5-25 µl ml^{-1}), produced from *Eucalyptus camaldulensis* tree, were investigated against tomato root rot and wilt disease caused by soil-borne fungal agents *Rhizoctonia solani, Fusarium oxypsorum, Macrophomina phaseolina* and *Verticillium dahlia in vitro* conditions. The complete mycelial growth inhibition were recorded at the relatively low concentrations used for *R. solani* (12.5µl ml^{-1}) followed by *V. dahliae* (15.0µl ml^{-1}), *M. phaseolina* (20.0µl ml^{-1}) and *Fusarium oxypsorum,* (25.0µl ml^{-1}).The effective concentration(EC_{50}) values were estimated as ranging between 3.58to 11.13µl ml^{-1}. Based on our primarily results, the wood vinegar has a potential to be applied as bio-fungicide against important soil-borne plant fungal disease agents. However, it is of great importance to carry out studies to determine the mechanisms and chemical compositions of wood vinegar that play a role in preventing the growth of fungal agent.

Keywords: *Antifungal activity, Wood vinegar, Pyrolysis, Soil-borne, Tomato.*

THE CHEMICAL CONTROL OF BACTERIAL CANKER ON CHERRY

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Abstract

Bacterial canker, caused by *Pseudomonas syringae* pv. *syringae* (*P. s.*pv. *syringae*) is one of the most economically important diseases of stone fruit trees. Disease symptoms include blossom blast and spur dieback, leaf and fruit lesions, cankers with associated with gummosis of woody tissue, and overall decreased fruit yields. For management of bacterial canker, copper compounds are suggested as a standard compound for controlling many bacterial diseases Field trials were conducted on cherry (*Prunus avium* L.) (the variety of Ziraat 900) to evaluate the efficacy of some copper compounds including copper hydroxide, copper sulfate, copper oxychloride, and fosetyl-al and copper+mancozeb separately, on the severity and incidence of this disease. A visual rating system of 0 to 5 was used to the severity of bacterial canker associated with symptoms on the tree. Randomly, 50 branches were collected from each tree to evaluate the incidence of bacterial canker. Results indicated that the use of copper hydroxide significantly reduced bacterial canker as determined by overall disease rating among all trees and disease severity among infected trees, compared with the untreated inoculated control (85.72%). Also, the use of copper sulfate and copper oxychloride decreased the percentage of disease severity by 80.96% for both. According to the results, all treatments were effective in decreasing bacterial canker on cherry. However, the use of copper compounds especially copper hydroxide was showed a highly controlling *P. s.* pv. *syringae* in the cherry orchard.

Keywords: *cherry, copper, chemical control, bacterial canker.*

AGRICULTURAL PRODUCTS GRADING METHODS AND THEIR ASSOCIATED CHALLENGES

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Abstract

Modern agriculture aims at increasing production and reducing losses to meet the ever-increasing food demand. Agriculture faces a number of difficulties at different phases of production. Post-harvest losses are one of the biggest challenges in the agricultural sector in the world, especially in developing countries. Food and Agriculture Organization estimations indicate that post-harvest losses of cereals and grain legumes in many developing countries are about 15%. In some regions of Africa and Latin America, higher rates of up to 50% of the quantities harvested are lost. The huge amount of losses considerably reduces the amount of food that would be available in the market for the final consumers. Lack of appropriate processing technologies related to sorting and grading of products is among the principal factors contributing to post-harvest losses. A number of different measures are being taken to reduce this problem, however, there are still significant losses in post-harvest. It is clear that the basis for grading is the physical and mechanical properties of the products, therefore the efficiency of the method depends on its ability to fully exploit and utilize these properties. This study will review the grading methods used in developing countries, their contribution to post-harvest losses, their associated challenges and will finally recommend the application of machine learning to improve the performance and efficiency of the grading methods.

Keywords: *Machine learning, grading, post-harvest losses.*

TECHNOLOGICAL INNOVATIONS IN PESTICIDE APPLICATIONS

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Abstract

One of the most important problems of the rapidly increasing world population in the future and today is to meet the food need. The most important factor that will contribute to the solution of this problem is to increase agricultural production. Considering that agricultural areas are shrinking due to different reasons,efforts to increase the yield per unit area gain importance. Since diseases, pests and weeds in agricultural production can cause about 35-50% loss of product when no control is made, agricultural control should be done effectively and correctly in order to increase yield and quality. The most commonly used method in agricultural control is chemical control. In the application of pesticides used in chemical control,effective and correct use of new technological systems and methods is extremely important in order not to adversely affect human health, food safety, environment and natural balance, and to reduce production costs. Within the scope of smart agriculture applications,global positioning system (GPS), Variable rate application technologies (VRA), unmanned aerial vehicle (UAV), active sprayer boom suspension systems, modulated spraying-nozzle control system (MSNC), controlled drop applications (CDA), electrostatic spraying technique, pesticide applications are seen as technological innovations on which studies are concentrated. The use of smart agricultural technologies is increasing day by day in pest control practices in field crops. In these technologies, the importance of environment and human health is emphasized and studies are carried out on methods that reduce pesticide. At the same time, it is aimed to reduce effective results and economic inputs in pesticide applications. Success in pesticide applications depends on effective and correct pesticide application parameters and targeted application of pesticides. The application possibilities of smart agriculture applications will play an active role in achieving this success.

Keywords: *Pesticide, Sprayer, Smart agricultural technologies, Plant protection, Unmanned aerial vehicle.*

IMPACT OF MACHINE LEARNING IN AGRICULTURAL RESEARCH

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Abstract

Each year, agronomists and farmers struggle with numerous questions regarding which seeds to plant, when to plant, how much input to apply to optimize yields, and when to harvest. Besides, the burden of analyzing and predicting the effects of a wide range of complex entities such as weather, disease, and varying consumer preferences is huge. The usual and yet unsolved question of food demand alarms everywhere. Although many claim that, several local crops could contribute to the global food supply, it is doubtful without further research and innovation. For decades agricultural researches, have been aiding farmers in improving agricultural systems and optimizing production. Agricultural research may include breeding improved seeds, enhanced plant protection, efficient irrigation, safe storage methods, new mechanizations, and others. In research, conducting extensive experiments to assure the credibility and quality of a product is necessary. However, in all these circumstances and research pathways, testing all possible research ideas and innovations is time-consuming and costly while the lack of sufficient and sustained funds is a key constraint in most developing countries. Hence, facilitating the diffusion of agricultural innovations and improved crop varieties in developing countries without disturbing the processes that lead to efficiency is timely and indispensable. In recent years, Machine learning techniques that can model complex inputs with complicated interactions have been widely used in agricultural activities. Thus, this article addresses and presents the importance, application, and impact of Machine learning in agricultural research, emphasizing facilitating research while reducing production costs and time.

Keywords: *Neural Network, Data, Agriculture.*

EXTRACTION METHODS, COMPOSITION AND BIOACTIVE PROPERTIES OF SOME MEDICINAL AND AROMATİC PLANT ESSENTIAL OILS

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Abstract

In this study, essential oil sources, essential oil extraction methods and essential oils cognition were investigated. Essential oils obtained from aromatic plants or herbal drugs are oily mixtures that are liquid at room temperature, have volatile properties as well as their unique smell, taste, color and appearance. Essential oils is an oil obtained by various extraction methods from parts of plants or vegetable sources such as root, rhizome, stem, leaf, stem, fruit, seed, shell, flower and bud. Essential oils are generally obtained by steam distillation from the essential oil-bearing parts of the plant. Essential oils in plants are formed in glandular hairs, secretory cells, secretory channels and secretory pockets, which are the secretory systems of plants. This oil is a mixture that is liquid at room temperature, can sometimes freeze, crystallize easily, evaporate, and have a strong odor and greasy. Most of the essential oils (90%) are composed of terpenic substances. Terpenic substances are found in essential oils as monoterpene, sesquiterpene and diterpene. Essential oils contain straight-chain hydrocarbons and sulfur-bearing compounds. The biological activities of various edible plant essential oils have been confirmed and it has been stated that these essential oils have protective potential in food systems.

Keywords: *Aromatic plant, essential oil, extraction, composition.*

ENHANCEMENT OF OXIDATIVE QUALITY OF HEAT TREATED FERMENTED SAUSAGES BY BARBERRY (*BERBERIS VULGARIS* L.) EXTRACT

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Abstract

The aim of this study was to examine the effect of barberry extract (BE) as a natural antioxidant in nitrite-free heat treated fermented sausages during 3 months of storage. For this purpose, barberry exract was prepared by using microwave-assisted solvent extraction method. In order to evaluate the antioxidant characteristics, DPPH, total phenolic compounds, flavonoids, and anthocyanins of BE were measured. Subsequently, 200 ppm gallic acid equivalent of BE was measured and incorporated into the fermented sausage formulation (BFS). DPPH, total phenolics, flavonoid, and anthocyanincontents of BE were 42.46 µmolTE/g, 33.16 mg GAE/g, 40.35 mg CE/g, and 10.9 mg/g, respectively. While the chemical composition was not affected by addig of BE, pH value of fermented sausage decreased with the addition of 200 ppm gallic acid equivalent of BE due to the acidic nature of extract. Incorporation of BE lowered the peroxide and TBARS values which were indicators of lipid oxidation. Both peroxide and TBARS values were increased then compared with the control and BE added samples during the storage. Decrements observed in lipid oxidation were thought to be associated with the progression of protein oxidation. Protein oxidation of sausages was monitored with carbonyl and sulfhydryl contents. Carbonyl contents of fermented sausage were lower in sample formulated with BE, while sulfhydryl content of BFS was higher than in control. Total losses of sulfhydryl groups in BFS and control were similar. In conclusion, results of this study proved that adding of BE could carry a potential attempt in heat-treated fermented sausage production.

Keywords: *Fermented sausage, Lipid oxidation, Protein oxidation, Barberry extract.*

CHEMICAL COMPOSITION AND ANTIBACTERIAL ACTIVITY OF ESSENTIAL OIL OF MINT PLANT AGAINST SEED-BORNE BACTERIAL DISEASE AGENTS

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Abstract

Plant diseases caused by seed-borne bacterial pathogens place major constraints on vegetable crop production in Turkey and cause significant annual losses on a global scale. The aim of the present study was to investigate chemical composition and antibacterial activity of essential oil obtained from grapefruit fragrant Mint (*Mentha* x *piperita* f.sp. *officinalis* var. 'Aura') plant. Chemical composition of the essential oil was identified by Gas Chromatography coupled with Mass Spectrometer detector (GC-MS). According to the result of GC-MS analysis, 39 components were identified, accounting for 99.94% of the whole essential oil. The main components were linalool (57.86%), linalyl acetate (29.76%), α-terpineol (%3.69) and geranyl acetate (3.39%)). Antibacterial activity of essential oil was determined against five different economically important Gram-negative seed-borne plant bacterial disease agents such as bean halo blight disease agent *Pseudomonas syringae* pv. *phaseolicola*, tomato bacterial speck disease agent *Pseudomonas syringae* pv. *tomato*, tomato pith necrosis disease agents *Pseudomonas cichorii*, *Pseudomonas corrugata* and potato soft rot disease agent *Pectobacterium carotovorum* subsp. *carotovorum* by using paper disc diffusion assay. Based on inhibition zone diameter values, essential oils showed the highest antibacterial activities against *P. carotovorum* subsp. *carotovorum* (11.3 mm), followed by *P. syringae* pv. *phaseolicola* (10.7 mm), *P. cichorii* and *P. syringae* pv. *tomato* (8.7 mm). Essential oil did not displayed antibacterial activity against *P. corrugata.* Based on our results, the essential oil of mint plant collected from Hatay province has a potential to be applied as seed disinfectant against important seed-borne plant bacterial disease agents.

Keywords: *Antibacterial, Seed-borne, Essential oil, Mentha* x *piperita, Mint.*

ISOLATION AND IDENTIFICATION OF PUTATIVE PLANT GROWTH PROMOTING BACTERIAL SPECIES FROM *DATURA INOXIA* MILL. GROWING IN TURKEY

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Abstract

The genus *Datura* (family Solanaceae) consists of nine species which are known since antiquity for their narcotic and medicinal potentials. Plant-Growth-Promoting Bacteria (PGPB) play an important role in plant growth promotion by increasing nutrients uptake, mineral solubilisation and protect host plant against their potential pathogens by producing antimicrobial compounds and inducing active disease resistance mechanisms. Research on population dynamic of Plant-Growth-Promoting Bacteria (PGPB) residing on medicinal plants is limited. The investigation was carried out to isolate and identify the epiphytic and endophytic PGPB isolatesfrom the different parts of *Datura inoxia* Mill. growing wild in Turkey. The endophytic and epiphytic PGPB populations were investigated in roots, leaves, stems and fruits of *D. inoxia* Mill. In this study, thirty-five putative PGPB isolates were recovered from wild grown plants collected from different districts of Hatay Province. Among putative bacterial isolates, twenty three isolates were identified to species level using Matrix-Assisted Laser Desorption Ionization Time of Flight Mass Spectrometry (MALDI-TOF MS). The PGPB communities of *D. inoxia* Mill. comprised of 15 different isolates of *Bacillus* spp.(15), *Pseudomonas* (1), *Pantoea* (3), *Serratia* (2), *Cryptococcus* (1) and *Paenibacillus* (1). Since endophytic and epiphytic flora associated within this plant could be a potential source of novel bioproducts of great importance in sustainable agricultural practices, studies are in progress to determine the biocontrol potential and plant growth promoting traits of obtained isolates.

Keywords: *Datura inoxia, Plant Growth Promoting Bacteria, MALDI-TOF, Biocontrol*.

IDENTIFICATION OF *XANTHOMONAS CAMPESTRIS* PV. *CAMPESTRIS* ISOLATES CAUSING DISEASE ON CABBAGE IN NİĞDE PROVINCE OF TURKEY

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Abstract

Black rot disease caused by *Xanthomonas campestris* pv. *campestris* is one of the most hazardous disease of cabbage which is an economically important vegetable cultivated in Turkey. Between November and December of 2019, 27 cabbage fields were surveyed in Bor district of Niğde province which is the largest producer of Turkey. Plants showing v-shaped necrotic lesions with surrounding yellow halo and blackened veins collected from 15 different fields with a disease prevalence of 55.5% for isolation. Infected leaf tissues containing veins were macerated and suspensions were streaked on King B medium. Growth of yellow, convex, mucoid colonies was checked after incubation at 28°C for 72 h. Isolated colonies (n=20) were Gram-negative, aerobic, non-fluorescent on King's medium B (KB), oxidase negative, caused a weakly hypersensitive reaction on tobacco and able to hydrolyse gelatine and aesculin. Fifteen bacterial strains representing field surveyed produced a single and 619 and 445-bp PCR amplicons with DLH120/125 and ZUP2311/2312 primers specific for *X. campestris* pv. *campestris*. Strains caused typical symptoms identical to those observed on naturally infected plants in the field. According to biochemical, physiological, pathogenicity and molecular studies, identity of strains were confirmed as *X. campestris* pv. *campestris* All strains could able to grow on KB medium amended with 50 and 100 ppm of streptomycin sulphate, 1.25 mM and 2.5 mM of copper sulphate.

Keywords: *Identification, Bacterial disease, Black rot, Xanthomonas campestris* pv. *Campestris.*

REMOTE SENSING AND GIS IN AGRICULTURAL PEST INSECT MONITORING: THE STATE OF THE ART IN TURKEY

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Abstract

Turkey with its geographical location and favorable climate has very rich fauna in terms of insect biodiversity, including especially agricultural plant pests. Agricultural pests destroy an estimated up to 30% of annual crop production worldwide. Keeping agricultural pests under control is very important to reduce the economic losses caused by insects in crop production. Monitoring and correct pest damage identification help us decide whether management is needed. The advanced techniques such as remote sensing and geographic information system (GIS) have become important tools for sustainable agricultural management. Recently, remote sensing and GIS techniques support a new approach for monitoring and determining the damage levels of insect pests in agriculture. The main objectives of these techniques are to collate data that help to estimate possible insect damage and make a decision for determining the most effective insect pest management. These systems have been used in collecting, mapping, analyzing the distribution of insect populations and predicting the damage of insect pests. There are several papers on the use of remote sensing and GIS techniques in agricultural pest control strategies. In this presentation, the some examples of remote sensing and GIS techniques in agriculture in the world are reviewed by focusing on monitoring and determining the damage levels of harmful insects that cause economic losses in the most common agricultural products such as hazelnuts, sunflowers, olives, cotton, cereals in Turkey.

Keywords: *GIS, Remote sensing, Insect pests, agriculture, Turkey.*

PROTIST PATHOGENS OF INDIAN MEAL MOTH *Plodia interpunctella* (LEPIDOPTERA: PYRALIDAE) IN TURKEY

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Abstract

Plodia interpunctella (Hübner) (Lepidoptera: Pyralidae) is a common storage pest all over the world. The protection of stored products is very important both to ensure food safety and to contribute to the country economy. In addition, insect allergens emerging from foods contaminated with *P. interpunctella* pose a serious threat to human health. Different methods are used to control *P. interpunctella*. The most common of these methods is chemical control. However, chemical control is not considered as a right choice for environmentally safe, efficient and sustainable pest control. Therefore, interest in entomopathogenic organisms (EPOs) is increasing. Entomopathogenic organisms are important biological agents for the control of pest insect populations due to their common and high infection in insects. Natural enemies of *P. interpunctella* such as viruses, bacteria, protists, fungi, nematodes and parasitoids have been studied in detail. The present study includes the first records on the distribution and occurrence of protist patogens in the populations of *P. interpunctella* from 11 localities representing all Turkey between in the period 2019-2020. During the study, 3.286 of *P. interpunctella* samples including larvae, pupae and adults were dissected and searched for protist pathogens. We found three entomopathogenic protists, microsporidium, coccidian and neogergarine. The presence of the microsporidian pathogen was found in all 11 populations (33.7%), coccidian pathogen in two populations (5.55%) and neogregarine pathogen in three populations (3.12%). The distribution and occurrence of protest patogens in the populations of *P. interpunctella* were also given and discussed with literature.

Keywords: *Indian meal moth, Plodia interpunctella, entomopathogen, biological control.*

EVALUATION OF POPULATION DENSITY OF DIAMOND BACK MOTH, *PLUTELLA XYLOSTELLA* (L.) (LEPIDOPTERA: YPONOMEUTIDAE) ON CANOLA PLANTS IN HATAY PROVINCE OF TURKEY

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Abstract

Diamond back moth, *Plutella xylostella* (L.) (Lepidoptera: Yponomeutidae), is one of the most important pests of cruciferous crops. In 2007, 2008 and 2009, the studies were conducted to determine the population density of diamond back moth on canola plants in Hatay province. The samplings were carried out every 15 days in five different canola fields and five canola varieties in 2007 and 11 different canola fields and five canola varieties in 2008, by using 25 sweep-net for each field. In 2009, the weekly sampling was taken by 25 sweep-net. In 2007, during the sampling period, the highest number of larva was recovered on 15 May and the variety "Lycosmos" had much more larva than other canola varieties. In 2008, during the sampling period, the higher numbers of the larva were recovered on 10 April; and the varieties "Elvis" (AtçanaC), "Sarı" (DemirköprüA) and "Hunter" (DemirköprüA) had much more larva than other canola varieties. In 2009, the higher numbers of the larva were recovered on 23 April comparing to the rest of sampling dates.

Key words: *Diamond back moth, Plutella xylostella (L.) Canola, Hatay.*

EVALUATION OF THE DAMAGE RATES OF LEOPARD MOTH, ZEUZERA PYRINA L. (LEPIDOPTERA: COSSIDAE) ON DIFFERENT OLIVE VARIETIES IN TURKEY

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Abstract

The leopard moth, *Zeuzera pyrina* L. (Lepidoptera: Cossidae), is one of the important pests of olive trees in Turkey. It is a xylophagous species that attacks the shoots and branches of numerous fruit-bearing olives trees in larval stage, and may cause the death of young trees or loss of the branches in old trees. The study was carried out to evaluate damage rates of the leopard moth in 'Gemlik', 'Ayvalık', 'Savrani', 'Haşebi' and 'Karamani' varieties of olive in orchards in Antakya, Yayladağ, Belen and Altınözü districts of Hatay province of Turkey. Evaluation of the damage rates caused by the pest was done in in each orchard by counting numbers of the damaged branches and trunks of olives trees. The damage rates caused by this pest varied in each of the inspected variety. The highest damages were observed in 'Gemlik' variety with 90 % located in Antakya (Arpahan village) district, following 'Gemlik' with 40 % located in Yayladağ district. On the other hand, the damages were not recorded at the 'Ayvalık', located in Belen district, 'Savrani', 'Haşebi', and 'Savrani' +'Karamani', located in Altınözü district of Hatay province in Turkey.

Key words: *Leopard moth, Zeuzera pyrina, olive trees, damages rates.*

SEASONAL ABUNDANCE OF *EMPOASCA DECIPIENS* (PAOLI) AND *ASYMMETRASCA DECEDENS* (PAOLI), (HEMIPTERA: CICADELLIDAE) ON COTTON PLANTS IN AMIK PLAIN OF HATAY PROVINCE

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Abstract

Empoasca decipiens (Paoli) and *Asymmetrasca decedens* (Paoli) (Homoptera: Cicadellidae) are among the most significant pests on cotton in Amik Plain. In 2008 and 2009, the studies were carried out in 50 cotton fields located in Kırıkhan, Reyhanlı, Kumlu, Demirköprü and Uydukent districts of Hatay province. From each district 10 different cotton fields and from each cotton field 25 sweep-net samplings were taken for each sampling. During the sampling period of 2008, a total of 3.113 adults of *E. decipiens* and *A. decedens* were collected from all the cotton fields sampled. The localities in which the highest numbers of those species sampled were in the following order: Demirköprü, Uydukent, Reyhanlı, Kırıkhan and Kumlu. Population of density differed depending on the sampling month. For example, in Reyhanlı, Demirköprü, Uydukent and Kırıkhan, caught numbers were higher in July than those in August. In Kumlu, however, numbers were observed to be parallel for July and August. During the sampling period of 2009, a total of 9.119 adults of *E. decipiens* and *A. decedens* were collected from all the cotton fields sampled. The localities in which the highest numbers of those species sampled were found could be put in the following order: Kırıkhan, Demirköprü, Reyhanlı, Kumlu and Uydukent. Population of density differed depending on the sampling month. For example, in Kumlu, Demirköprü and Kırıkhan, caught numbers were lower in July and August than in September and October, whereas in Reyhanlı and Uydukent, numbers were lower in July and September and higher in August and October. In general, population density of leafhoppers in Kırıkhan, Demirköprü and Uydukent were significantly higher than those of Reyhanlı and Kumlu.

Key words: *Empoasca decipiens, Asymmetrasca decedens, cotton plant, Hatay.*

SİDE EFFECTS OF SOME ESSENTİAL OİLS ON *TUTA ABSOLUTA* (MEYRİCK, 1917) (LEPİDOPTERA, GELECHİİDAE) LARVAE UNDER LABORATORY CONDİTİONS

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Abstract

Toxicity and repellent effect of essential oils (safflower, lavander, sage, clove) were tested on the third and fourth larval stages of Tomato leaf miner, *Tuta obsoluta* (Meyrick, 1917) (Lepidoptera: Gelechiidae) under laboratory conditions. Three different concentrations (1%, 3%, 5%) were used for treatments. Effects of essential oils were studied using contact method. Pure water and alcohol mixture were used in the control trials. Counts were recorded as dead and live larvae at 24, 48 and 72 hours after application. The experiment was carried out in three replications. The most notable result of this study was the mortality effect (100%) of safflower and clove oil on tomato moth larvae at concentrations of 5%. The other essential oils had a little larvicidal effect. Besides, lavander oil showed repellent effect on the larvae. However, the effect of oils should also be studied on the natural enemies of *T. absoluta*.

Key words: *Tomato, Tomato leaf miner, essential oil, alternative control, toxicity.*

APPLICATION OF MACHINE VISION AND IMAGE PROCESSING TECHNIQUES IN ASSESSING THE QUALITY OF NUT PRODUCTS

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Abstract

Nuts are seed kernels that are widely used in cooking or eaten as snack. They contain a high, inedible outer shell that usually needs to be cracked open to release the kernel inside. Nut products are always high in fat content and calories. The most commonly consumed nuts are: hazelnuts, peanut, walnut, almonds, cashew nuts, and pistachio nuts. Various factors can affect the quality of nut products during production, harvesting, post-harvest, and storage processes, such as: environmental factors, storage method, and corresponding storage conditions. These factors are mostly affecting the flavor, appearance, texture, color, and also the nutritional values of these products. This, in turn, affects the acceptability of the product by the consumers, as well as the marketability. Application of post-harvest quality control processes is very important to improve the quality and increase the product acceptability. Machine vision and image processing techniques are largely used as post-harvest quality control processes for classification, sorting, grading, and evaluating the quality of different agricultural products due to their consistency, objectivity, and reliability. In the current article, the general construction of the machine vision systems, application of machine vision and image processing techniques in evaluating the quality of different nut products are addressed.

Keywords: *Nuts, Almond, Hazelnut, Machine vision, Quality control***.**

DETERMINATION OF SOME PESTICIDE RESIDUES IN FOUR SPECIES OF *APIACEAE* FAMILY

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Abstract

Widespread use of pesticides worldwide has led to increased levels of residues that can be found in the environment and in foodstuffs. While this situation poses many health hazards for humans, it can also cause negative effects on animals and many ecosystems. These health hazards have been reported as acute, chronic and subchronic problems. Medicinal and aromatic plants are mostly grown in and collected from nature, however in recent years, the majority of them are cultivated due to their potential to be marketed. Therefore, chemical fertilizer and pesticide applications are increasing in order to ensure plant growth, to obtain high yield and quality, to compensate for nutrient deficiencies, and to protect the plant from diseases and pests in medicinal plant cultivation. In multi-residue analyzes of dried plant and spices, critical analytical problems arise due to the low water content and the presence of high amounts of coextractable components with analytes. Dried herbs contain high concentrations of essential oils, flavonoids, phenolic compounds, lipids, pigments and sugar. The main problem in gas chromatography is its sensitivity to matrix effects that adversely affect its quantification and quality, especially in the analysis of complex samples such as medicinal plants, tea, tobacco, cereals or dried fruits. In the quantitative determination of multiple pesticide residue analyzes in gas chromatography, many different approaches have been tried to minimize or eliminate matrix effects. Different variations of QuEChERS extraction method have been used for pesticide residue analysis in complex matrices such as herbs, teas and spices containing high concentrations of pigments and secondary metabolites. Within the scope of the study, 141 pesticide residues were analyzed in *Pimpinella anisum L, Cuminum cyminum L., Coriandrum sativum L.* and *Foeniculum vulgare L.* samples. For this purpose two different methods, QuEChERS and Gel Permeation Chromatography, were applied and GC/ECD, GC/FPD, GC/MS techniques were used for residue analysis. No pesticide residues were detected in samples.

Keywords: *Pesticide residues, QuEChERS, Gel Permeation Chromatography, Apiaceae.*

DETERMINATION OF ESSENTIAL OIL COMPONENTS, MINERAL MATTER, AND HEAVY METAL OF CLARY SAGE (*SALVIA SCLAREA* L.) COLLECTED FROM CENTRAL ANATOLIA IN TURKEY

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Abstract

Clary sage (*Salvia sclarea* L.) is an important aromatic plant cultivated to obtain essential oil throughout the world. *Salvia sclarea* L. (Clary sage) is a biennial or perennial herb between 20-120 cm tall, branched at the top, with a thick, upright stem. It has lilac, white or pale blue flowers. The plant, which develops rosette leaves in the first year, blooms the following year. Usually, flowering starts in May and continues until the end of August. Clary sage is commercially grown mainly in Russia, Bulgaria, France and Morocco, with an annual production of about 150 tons of essential oil in these countries. Clary sage essential oil is obtained from the flower parts in full bloom. The aim of the study is to determine the quality of clary sage essential oil, and mineral matter content, growing in natural environment in Central Anatolia. In this study, samples were collected from natural environment in Yozgat (0751558D-4393790K 1837 m), Central Anatolia conditions, during flowering periods in 2017. Flower parts in full bloom period essential oil ratio were found as 0.10%. The main components and its ratio of clary sage essential oil Sclareol, Sclareoloxide, and geranyl-p-cymene were determined as 37.74%, 8.33%, and 4.58%, respectively. Macro elements of flower parts Ca, K, P, and S were determined as 104.419, 432.161, 43.169, and 21.363, respectively. Micro elements Fe, Mn, Cu, B, and Na were observed 3.185, 0.867, 0.414, 0.125, 0.524, and 2.574, respectively. Heavy metals Al, Cd, Co, and N, were found as 2.91543, 0.00021, 0.00643, and 0.00508, respectively.

Keywords: *Clary sage, Salvia sclarea L., essential oil, mineral matter, Sclareol.*

PHYLOGENETIC ANALYSIS OF TWO UKRAINIAN ISOLATES OF CUCUMBER MOSAIC VIRUS FROM GLADIOLI GROWN UNDER DIFFERENT AGROECOLOGICAL CONDITIONS

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Abstract

Cucumber mosaic virus (CMV) is one of the most widespread and harmful viruses infecting gladiolus plants worldwide. The aim of the study was to perform a phylogenetic analysis of two CMV isolates from gladioli grown in different regions of Ukraine. For the first time, 443 nt sequences of the capsid protein (*CP*) gene of gladiolus isolates CMV-Gl-Skv-20 (MW847710) and CMV-Gl-SkvP-20 (MW847714) from Kyiv and Poltava regions, respectively, were submitted to the NCBI GenBank. Phylogenetic analysis showed that isolates clustered with different phylogenetic subgroups. CMV-Gl-Skv-20 belongs to subgroup IA, and has nucleotide (nt) sequence identity 81.9%-99.27% and amino acid (aa) identity 82.3%-97.6% with isolates from this group. The highest identity of the CMV-Gl-Skv-20 was found to be with Turkish CMVs from *Rapistrum rugosum* TUR83, TUR86 and *Brassica* TUR4 (98.8%-99.3% nt and 97,6% aa), as well as with Australian isolates Ny and 207 from tomato, and banana isolate Cameroon (98.9%-99% nt and 97,6% aa). CMV-Gl-SkvP-20 belongs to subgroup IB and shares 95.8%-100% nt and 96%-100% aa identity with the members of this subgroup. CMV-Gl-SkvP-20 has the highest identity with Ukrainian isolates from cucumber Ukr-1409 and *Echinacea* P-EP-Ukr-19 (99.5%-100% nt and 99.2-100% aa), Chinese pumpkin isolates ZBR, WHR, isolate lu-17-14 from sweet potato and SXCH from *Bupleurum sp.* (98.3-99% nt and 98.4%-99.2% aa), as well as with gladiolus South Korean isolate ABI (98.3% nt and 97.7% aa). The results testify in favor of the fact that gladioli are affected by CMV not only through the corms, but by vector insects circulating in growing areas.

Keywords: *cucumber mosaic virus, gladiolus, coat protein gene, phylogenetic analysis, Ukraine.*

3.ORGANIC AGRICULTURE

CHEMICAL-PHYSICAL PROPERTIES AND QUALITY OF HONEY FROM ORGANIC GROWING FROM THE AREA OF SOUTHERN HERZEGOVINA

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Abstract

Beekeeping, and thus honey production, has a very long tradition in Bosnia and Herzegovina. Due to the very favourable sub-Mediterranean climate conditions, and rich biodiversity, and especially a variety of medicinal plants, honey from the area of southern Herzegovina is a highly valued and sought-after product. On the list of 10 foods with the highest risk of counterfeiting, honey ranks sixth. This paper analyses samples of honey from organic farming from three locations in Herzegovina, namely Gornja Duboka, southeast of Stolac, Bančići (a village located between Stolac and Ljubinje) and Počitelj-brdo in the municipality of Čapljina, in order to determine their quality and originality product. The samples were analysed for the following parameters: water content, content of water-insoluble components, total ash, reducing sugar content, sucrose content, acid content, HMF content and electrical conductivity. The results of the analyses were compared with the reference values and statistically processed. The obtained results showed that all parameters, on which honey samples from all three localities were tested, were in accordance with the reference values prescribed by the Book of rules on honey and other bee products. From the obtained results of chemical and physical analyses, it can be concluded that all samples are natural, that they are not fake and that it is honey of very good quality.

Key words: *honey, location counterfeiting, parameters, chemical-physical properties, quality.*

CHEMICAL COMPOSITION OF MEDLAR (*MESPILUS GERMANICA*) AND WILD SERVICE TREE (*SORBUS TORMINALIS*) – UNDERUTILIZED EDIBLE FRUITS FROMBOSNIA AND HERZEGOVINA

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Abstract

Medlar (*Mespilus germanica* L.) is an old fruit species that is not present in production plantations and on larger areas in B&H and neighboring countries. It can mostly be found in backyards, as a sporadic fruit tree. Wild service tree (*Sorbus torminalis* (L.) Crantz) is a species of semi-shade, a regular companion of oak forests, with a wide ecological valence. Apart from belonging to the same family (*Rosaceae*), their fruits are both edible and medicinal, can be consumed only if *bletted* (softened by frost) and are characterized by a similar taste. The fruits of checkers were harvested on the mountain Manjača, while the fruits of medlar were collected from an old orchard in the suburbs of Banja Luka. Fruits were analyzed on the following: moisture, dry matter, total sugars, total acidity, mineral content, pectin, vitamin C, elements (Al, Ca, Cd, Cr, Cu, Fe, K, Mg, Mn, Mo, Na, P, Pb, Se, Zn), total phenols, flavonols, flavonoids, non-flavonoids and anthocyanin. Analyzes were carried out in four parallel repetitions and the results are expressed as mean value ± standard deviations. The obtained results show that the fruits of the observed species have a rather uneven elemental composition, with the exception of Na and P. The fruits of checkers contain more vitamin C (15.80 mg/100g) than medlar (4.44 mg /100g). They are also superior in terms of total phenols, flavonoids and non-flavonoids (2416.49; 1299.33; 1117.16 μgGAE/g, respectively) compared to medlar (530.3; 36.14; 513.5 μgGAE/g, respectively). The same is the case with total flavonols (323.51 vs. 174.97 μgQE/g). The fruits of checkers contain an average of 301.24 μg/g of anthocyanin, which are not registered in medlar fruits.

Key words: *medlar, wild service tree, nutrition value, element concentration, bioactive compounds.*

CHEMICAL COMPOSITION OF YELLOW GENTIAN ROOT (*GENTIANAE RADIX*) FROM BOSNIA AND HERZEGOVINA

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Abstract

It has long been known that certain parts of yellow gentian have medicinal and edible usage value and that as such they find their application in pharmaceutical and food industries as well as in traditional medicine. Yellow gentian (*Gentiana lutea* subsp. *symphyandra* (Murb.) Hayek) is a protected (sub) species in Bosnia and Herzegovina because it is considered endangered. The main reasons for this are over-exploitation and relatively slow natural regeneration. Working on the project of its mass reproduction, we collected and analyzed samples of yellow gentian`s rhizome and root from the mountain Šator in B&H. We found that *Gentianae radix* contained about 66.9% water and about 33.1% dry matter. Total sugars awee represented by 5.63%, fats with 3.14% and pectins with 1.04%. Among analyzed elements, the most prevalent was calcium with an average concentration of 3208.7 mg/kg and the least represented was chromium with an average concentration of 0.44 mg/kg. The main part of the mineral spectrum consisted of three elements: Ca, K and Mg, with a share of 93.4%. In *Gentianae radix*, 23 fatty acids were detected, of which 12 were saturated and 11 unsaturated. The ratio of saturated to unsaturated fatty acids was 43.16%:56.84%. The most common among saturated fatty acids was palmitic with a share of 26.52 %, while the most common unsaturated fatty acid was oleic with a share of 31.99 %. Regarding phytochemicals, *Gentianae radix* contained on average: total phenols – 3820.54 μgGAE/g, total flavonols – 568.22 μgQE/g, non-flavonoids – 4280.49 μgGAE/g and anthocyanin 710.71 μg/g.

Key words: *yellow gentian, rhizome and root, chemical composition, phytochemicals.*

CHICKPEAS AS A VALUABLE RAW MATERIAL IN FULFILLMENT OF THE GOALS OF THE BIOECONOMY

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Abstract

The guiding principle of EU bioeconomy and food safety policy is the application of an integrated approach covering all elements of the food chain, including feed production, plant and animal health, primary production by farmers, food processing, storage, etc. A familiar cereal and legume crop in Bulgaria is chickpea. Its main purpose is to feed people. In the process of technological processing of the grain, the husk is separated as a residual product, which is perceived as waste. The aim of the paper is to present the results of laboratory analyzes of chickpea husk. The results show that the husk has a high energy value, the content of starch, protein, amino acids, and crude fiber. Chickpea husks can be included as a feed additive in the form of flour for animal feed. This integrated approach in which a waste product is transformed into raw materials for food and feed production supports the added value of meeting the objectives of the bioeconomy.

Keywords: *bioeconomy, chickpeas, chickpea husks, Bulgaria.*

FUTURE TRENDS FOR DEVELOPMENT OF ORGANIC VINE AND WINE IN BULGARIA

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Abstract

This work was supported by the Bulgarian Ministry of Education and Science under the National Research Programme "Healthy Foods for a Strong Bio-Economy and Quality of Life" approved by DCM # 577 / 17.08.2018". Wine has been produced in Bulgaria for about 5000 years. The first wines were transported to our region from the Middle East. During the Thracian times wine was a part of daily life and pagan rituals in our territory. Organic production has existed since the 1980s. It develops in almost all countries in Western Europe and the United States. In the EU in 1991, the European Council of Ministers of Agriculture adopted Regulation No 2092/91 for organic production of agricultural products and their labelling. On the basis of this Regulation, the Regulation No 3 of 25 March 1998 of the Ministry of Agriculture and Forestry for the production of organic grapes and wines is adopted in Bulgaria, which defines the conditions and procedure for the production of organic grapes and wines, their certification and state control. The climatic conditions in Bulgaria for development of viticulture are extremely favourable. The climate changes from temperate continental in the northern part of the country to Mediterranean - in the south, which is a favourable condition for growing both white and red grapes. The production of organic grapes is a subject of much discussion because of the specificity of viticulture, which is a labour-intensive industry that does not allow a high degree of mechanization. Further information about attitudes and practices for bio production gives the information from 75 interviews conducted with large and medium-sized grape producers in 2018 in three of the six wine-growing regions of the country - South-East Viticulture Area, South Central Viticulture Area and the North Central Viticulture Area. The positive attitudes of the grape producers combined with the favourable soil and climatic conditions, experience and traditions in the wine sector, give reason to say that organic vine and wine production in Bulgaria has a perspective.

Keywords: *Organic vine, wine, production, Bulgaria.*

COMPARISON OF THE ANTIBACTERIAL POWER OF RAVINTSARA ESSENTIAL OIL (CINNAMOMUM CAMPHORA) IN RELATION TO ITS ORGANIC CERTIFICATION OR CONVENTIONAL

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Abstract

This study focuses on the essential oil (EO) of Ravintsara (Ravintsarae) and its antibacterial and antifungal effect according to its biological or non-biological character. By carrying out antibiograms we sought to measure the effects of organic and non-organic essential oil at different concentrations on bacterial, yeast and fungal strains. These experiments revealed a subtle difference in efficacy between the two oils on these different microorganisms. However, both oils were found to be ineffective on the two fungal strains tested. Gas chromatography (GC) was used to reveal the proportions of all the active ingredients responsible for the antibacterial and antifungal effect in these two Malagasy oils. After analysis of the data, we were able to conclude that the difference in effectiveness between the two oils was not significant. Thus, the compositions of Ravintsara EO from the organic and non-organic sector are extremely close. However, it would be interesting to combine these tests with the analysis of the distillation processes and the analysis of the soil and climatic conditions to explain the analysis further.

Key words: *Ravintsara Essential oil, organic and conventional, antibacterial effect.*

SHORT AND LONG TERM EFFECTS OF DIGESTATE FERTILIZATION ON NITROUS OXIDE EMISSIONS IN A FIELD EXPERIMENT IN SOUTHERN GERMANY

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Abstract

As the biogas sector has grown over the past 20 years, more biogas digestate (BD), the nutrient-rich residue from biogas production, has been produced and used as fertilizers in organic agriculture. However, the effect of BD on soil processes, nitrogen dynamics, and hence the emission of climate-damaging N_2O is not completely understood. For this reason, the long-term effects, after-effects and direct effects of BD on N_2O-emissions, yield formation and soil nitrogen-dynamics were investigated in a long-term trial in southern Germany under the conditions of organic agriculture. N_2O-emissions were measured with the "closed-chamber-method" once a week from March in 2019 until August in 2020 in winter wheat. For the same period, weather conditions, soil water content, and ammonia and nitrate content were analyzed. In both years, the highest yields and the highest N_2O-emissions were found in the long-term fertilized variant with 1.5 and 3.3 kg ha^{-1} N_2O-N and 8.1 and 7.0 Mg ha^{-1}, respectively in 2019 and 2020. The after-effect and the first-time effect of BD regarding N_2O and yield showed stronger in 2019, whereas in 2020, there was only a difference between the fertilized and unfertilized variants. The test site showed a high N_2O-emission potential, which, however, was strongly dependent on the year and the weather conditions. We found significant differences in N_2O-formation regarding long- and short-term effects as well as direct and after-effects when fertilized with BD.

Keywords: *Nitrous oxide emissions, N_{min}-dynamics, Organic farming, Biogas digestate.*

INNOVATIVE COMBINE HARVESTING AS AN APPROACH FOR INTEGRATED NON-CHEMICAL WEED CONTROL IN CENTRAL HESSEN/ GERMANY

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Abstract

Standard combine harvesters release weed seeds that are taken up during the threshing process on the fields. Thus weed seeds can be spread over vast areas on the fields as studies have shown. Standard cereal harvest is though potentially forcing up current challenges of weed control that already exist. This issue is picked up in the context of developing an innovative combine harvesting technique. The new technique bases on a gadget collecting weed seeds during the threshing process. In this study, the impact of innovative combine harvesting has been analyzed with regard to the occurrence ofwild arable plant species and the effectivity of collecting weed seeds during threshing process. It was figured out that the new technique has the potential to reduce weed seed inputs to the soil seedbank. Rates for collecting weed seeds were usually higher in organic cropping systems than in the conventional alternative. Over both years of the field trial in 2019 and 2020, 25 different arable plant species could be picked up by innovative combine harvesting. Among these, there were 19 herbal species and six grass species. As an example for collecting grass seeds with the innovative combine harvesting method, the collection rates were estimated for seeds of *Bromus secalinus.* In the field trial a major proportion of 60% of the current seed potential of the field could be retained. Another 31% of *Bromus*-seeds were released on the field and 9% were retained by the grain tank of the combine harvester.

Key words: *harvesting, weed control, Germany.*

NITROGEN BALANCES OF DIFFERENT ORGANIC AND CONVENTIONAL FARMING SYSTEMS – RESULTS OF A LONG-TERM EXPERIMENT IN SOUTHERN GERMANY

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Abstract

Nitrogen is the most important nutrient in agricultural systems and often the yield-limiting factor. However, high N inputs can lead to emissions and negative environmental impacts. N balances can help identifying N loss potentials, optimize cropping systems and are key for understanding the N cycle. Previous studies examined the differences between organic and conventional farming systems, but failed to differentiate within these farming systems. The Viehhausen System Trial (VST), located in southern Germany, 30 km north of Munich, addresses this issue and represents a new experimental approach. The long-term experiment was established in 2009 to study the effects of different organic and conventional farming systems on crop productivity, environmental impacts and sustainability. The trial consists of four organic cropping systems (Stockless, Cattle-Slurry, Cattle-Manure, Biogas) and two conventional cropping systems (Stockless, Cattle-Slurry). In contrast to classical one- or two-factorial experiments, the systems are characterized by a simultaneous adjustment of the three factors (agronomic management, fertilization and cropping sequences) to ensure a system-conform simulation. This study analyses and compares the N balance and nitrogen-use efficiency based on ten trial-years of the VST. Results show that conventional Systems have higher N inputs, but also high yield levels and thus a mean nitrogen surplus of 23 kg ha^{-1}. Organic Systems have lower N inputs, higher nitrogen-use efficiencies and balanced N surpluses. Differences were also found within the organic and conventional systems, with the organic cattle slurry system having the lowest and the conventional cattle slurry system having the highest nitrogen surplus.

Keywords: *Nitrogen balance, Organic farming, Conventional farming, System comparison.*

OENOLOGICAL CHARACTERISTICS AND VINIFICATION RESULTS OF THE YEAST OF MALAGOUSIA GRAPE ISOLATED IN GREECE

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Abstract

Malagousia grapes, selected from 5 different PGI Greek zones, in 3 different growing seasons (2018-2019, 2019-2020, 2020-2021) were collected in the stage of technological maturity. Quantity of 25 Kg grapes fermented spontaneously in 30 l thermo regulated stain steel tanks, produced white wine. The indigenous yeast flora, isolated at three phases of the alcoholic fermentations, was studied. Different yeast species were isolated, purified and characterized. The restriction fragment length polymorphism of PCR-amplified fragments from the rDNA gene cluster (PCR RFLP of rDNA) has been used for the differentiation of yeast species. The standard identification procedure has been performed on representative strains that shared identical RFLP profiles showed great diversity of the yeast population. Including grape berries, must and fermented must, the following yeast species were identified: a number of Pichia and Candida species, Kloeckera apiculata, Cryptococcus curvatus, Metschnikowia pulcherrima, Kluyveromyces, as well as Saccharomyces cerevisiae and Saccharomyces stranieri. We performed microscopic, macroscopic and carbon assimilation tests by API 32C standardized system, biotechnological testing and hydrolase profiling obtained by the API-ZYM system. The most significant findings in population dynamics of yeasts in the spontaneous fermentations were bigger diversity of different species of Non-Saccharomyces in organic grapes and almost complete absence of non-Saccharomyces species, at least at grapes and at the beginning of the alcoholic fermentations at conventionally cultivated grapes, from all the examined PGI zones in all the three years of the study. The use and enhancement of indigenous yeasts is an increasing trend. Rapid identification of the yeast population is necessary for successful monitoring of the fermentation process and for obtaining a good wine quality as well as contributing to the optimization of Greek wine production.

Keywords: *Yeast strain selection, Spontaneous alcoholic fermentation, organic grapes.*

ROLE OF RHIZOBACTERIA IN PLANT DEFENSE SYSTEM

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Abstract

Induced systemic resistance (ISR) ascended as a mechanism in which certain Plant Beneficial Rhizobacteria (PBR) and fungi produce immune boosters which indirectly endorses the crop growth and makes it resistant against various phytopathogens, insects, and pest parasites. These beneficial rhizobacteria and mycorrhizae can improve plant performance by regulating the hormone signaling including salicylic acid, jasmonic acid, prosystemin, PR1, and ethylene pathways which activate the gene expression, synthesis of secondary metabolites, various enzymes, and volatile compounds that eventually induce the defense mechanism of the plant. To protect themselves from disease, plants have advanced cultured defense mechanisms in which Local acquired resistance (LAR), Systemic gene silencing (SGS), Systemic wounding response (SWR), Systemic acquired resistance (SAR), and Induced systemic resistance (ISR) are involved. Several rhizobacteria activate the salicylic acid (SA) dependent SAR pathway by producing salicylic acid at the surface of the root while other rhizobacteria activate different signaling pathways independent of Salicylic Acid, SA-independent ISR pathway which is dependent on jasmonic acid (JA) and ethylene signaling. This review also insights genetic approaches to suppress disease-causing genes, such as RNA interference and antisense RNA which are still underutilized in sustainable agriculture. Moreover, it gives an insight into VIGS (a virus-based tool). Although research on soil and crop microbiome has increased over the past few years, understanding of the role of PBR in plant health and growth and its defense is still poor. Hence the role of further and detailed studies on the role of plant-associated rhizobacteria and epiphytic and endophytic crop microbiome in plant's health, its immunity, and defense need to be explored. This review focus on types of induced resistance in the plant, experimental approaches of induced resistance, and the mechanism of induced systemic resistance along with signaling pathways.

Keywords: *PGPR, Induced Systemic Resistances, Jasmonic acid, Salicylic acid, Pathogenesis related proteins.*

HALOTOLERANT MICROBIAL CONSORTIA FOR SUSTAINABLE MITIGATION OF SALINITY STRESS; GROWTH PROMOTION, AND MINERAL UPTAKE IN PLANT AND SOIL NUTRIENT ENRICHMENT

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Abstract

Salinity has significant impact on the growth, development and reproductive biology of various crops like vegetables. The cultivable area is reducing due to accumulation of salts and physical, chemicals methods currently in use are not amenable to large extent to avoid such abiotic stress factor. The addition of microbes enrich the soil without any adverse effects. The effect of microbial consortia comprising of *Achromobacter* sp., *Bacillus* sp., *Delftia* sp., *Enterobacter* sp., *Achromobacter* sp., and was evaluated on the growth and mineral uptake in tomato (*Solanum Lycopersicum* L.) under salt stress and normal soil conditions. Salinity treatments comprising of Ec 0, 2, 5, and 8 ds/m were established by mixing soil with sea water until desired Ec was achieved. The seedlings were transplanted in the pots of respective pH and inoculated with microbial consortia. After sufficient gowth, these seedlings were translanted in soil Seedling trays. The measurement of soil mineral such as Na, K, Ca, Mg, Cu, Mn, and pH and Ec were evaluated and compared with the control after 0 day, 15 days and 35 days after inoculation. The results were found to be non significant for the soil parameters. In uninocluated seedlings (Control) Seedling trays, salt treatment significantly affected leaf, shoot and root dry weight, shoot height, number of secondary roots, chlorophyll and mineral contents. While bacterized seedlings sown under saline soil significantly increased leaf (105.17%), shoot (105.62%), root (109.06%) dry weight, leaf number (75.68%), shoot length (92.95%), root length (146.14%), secondary roots (91.23%), and chlorophyll content (-61.49%) as compared to the control (without consortia). The Na and K intake were higher even in the presence of the microbes but beneficial effect of the microbe helps plants to sustain in the saline environment. The inoculation of microbial consortia produced more number of secondary roots which accumulate more minerals and transport substances to the different parts of the plant as a result it produced higher biomass and growth. Results of the present study revealed that the treatment with microbial consortia can alleviate the deleterious effects of salinity stress and improve the growth of tomato plants under salinity stress. Use of microbial consortia appears to be the best alternative and cost effective and sustainable approach for managing soil salinity and improving plant growth under salt stress conditions.

Keywords: *Microbial consortia, PGPR, Tomato, Plant biomass, Salinity stress.*

ACILLIBACTIN : A NEW TYPE OF SIDEROPHORE FOR IMPROVEMENT IN PLANT GROWTH AND OIL CONTENT IN SESAME

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Abstract

Siderophores are low molecular weight secondary metabolites produced by microorganisms under low iron stress as a specific iron chelator. In the present study, a rhizospheric bacterium was isolated from the rhizosphere of sesame plants from Salem district, Tamil Nadu, India and later identified as *Bacillus subtilis* LSBS2. It exhibited multiple plant-growth-promoting (PGP) traits such as hydrogen cyanide (HCN), ammonia, and indole acetic acid (IAA), and solubilized phosphate. The chrome azurolsulphonate (CAS) agar plate assay was used to screen the siderophore production of LSBS2 and quantitatively the isolate produced 296 mg/L of siderophores in succinic acid medium. Further characterization of the siderophore revealed that the isolate produced catecholate siderophore bacillibactin. A pot culture experiment was used to explore the effect of LSBS2 and its siderophore in promoting iron absorption and plant growth of *Sesamum indicum* L. Data from the present study revealed that the multifarious *Bacillus* sp. LSBS2 could be exploited as a potential bioinoculant for growth and yield improvement in *S. indicum.*

Keywords: *Bacillibactin, bioinoculant, P solubilization, plant growth promotion, Sesamum indicum, siderophore.*

INTERLINKING BIO-PRIMING APPROACH WITH INTEGRATED NUTRIENT MANAGEMENT FOR IMPROVED NUTRIENT USE EFFICIENCY IN CROP SPECIES

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Abstract

The increasing demand for qualitative and varietal foods by the consumer society is a big concern for energy production, and utilization of that energy in a judicious manner for sustainable management of resources is a big challenge in the eminent future. Existing resources (land, water, fertilizer, etc.) and their socioeconomic aspects warrant the farming community to adopt alternative strategies aimed at enhancing the use efficiency of inputs and improve the environmental quality. The adaptability of microbes to thrive in different environments has prompted scientists to introduce microbial intervention in the agricultural processes. Bio-priming has the potential to fulfill many objectives of the modern production system with the use of beneficial microorganisms in an eco-friendly manner. Interestingly, it also plays a crucial role in enhancing the nutrient use efficiency of crops. There is rising evidence of a paradigm shift from the use of a single microbe to a consortium approach for efficient rhizosphere engineering in the context of sustainable agriculture. Our understanding of different signaling cascades, rhizosphere chemistry, and other mechanisms of plant–microbial interactions will frame suitable strategies to harness the best ecosystem services including improved resource use efficiency.

Keywords: *bio-priming, energy prices, nutrient mining, nutrient use efficiency, soil quality*.

EFFECT OF EXOGENOUS PUTRESCINE ON WINTER OILSEED RAPE RESPONSE TO LOW TEMPERATURE

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Abstract

Low temperature is the abiotic factor, which negatively affects the development and survival of plants. Unfavourable environmental conditions result in the loss of the yield. Several different strategies have been taken to enhance plant stress tolerance and crop productivity. One of them is the exposure of plants to exogenous biologically active substances. One of the classes of plant bioregulators are polyamines. Studies have reported increased levels of polyamines under stress conditions and demonstrated that the manipulation of content of polyamines improves environmental stress tolerance. The goal of current study was to evaluate the effect of exogenously applied polyamine putrescine on the winter oilseed rape response to cold stress. The study was conducted under laboratory conditions. A half of 26-day-old plants were sprayed with 1 mM putrescine water solution and another half was sprayed with water. Afterwards a half of each treatment group was subjected to –1 °C treatment, another half continued growing under 21 °C. Substantial plant stress biomarkers and the survival of tested plants were analysed in order to detect the effect of tested polyamine on winter oilseed rape response to low temperature. Current study showed that the exogenously applied putrescine affected winter oilseed rape cold stress response. Putrescine application significantly increased the rate of survival, promoted the accumulation of free proline and reduced ethylene emission when compared to control plants. Based on the data of current study it can be stated that exogenous putrescine modifies tested plant stress response characteristics and maintains its cold resistance.

Keywords: *Biomarkers, Canola, Cold stress, Polyamines, Low temperature.*

EFFECT OF PROBIOTIC COMPOSITIONS ON GROWTH, ANTIOXIDANT ACTIVITY AND PRODUCTIVITY OF BEETROOT

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Abstract

The research aimed to evaluate the impact of two plant commercial probiotics – ProbioHumus and NaturGel on the growth and chemical composition of beetroot (*Beta vulgaris* L.). The field experiment was established in a small-plots (1 m^2) design with four replications completed in randomized blocks. Probiotics (2 l/ha) were used twice. The seeds of plants were treated before sowing and seedlings were sprayed after the first real leaves appeared. Biometric parameters and chemical analysis of beet roots were performed after collecting yield. The results obtained testify the positive effect of probiotics on the root mass. The average mass of ProbioHumus-treated root crops reached 117.2 g, NaturGel-treated was 106.5 g, non-treated –91.0 g. ProbioHumus and NaturGel in combination had a positive effect on the monosaccharide content of crops. Their monosaccharide content exceeded more than 8% of ProbioHumus-treated plants and even 40% of untreated plants. Antioxidant activity of root crops was evaluated according to their free radical scavenging using the DPPH test. Plants treated with a mixture of both preparations showed 12.6% higher antioxidant activity than ProbioHumus-treated and 23.8% higher than untreated plants. Results on ProbioHumus-treated plants disclosed the highest content of the vitamin C compared to control, it exceeded by 18% more, and by 6% more compared to mixture treatment. All these results suggest that agricultural probiotic application will lead to better yield quality, solving the food quality and agro-environmental problems.

Keywords: *Antioxidant activity, Bioregulators, HPTLC, Plant probiotics, Root crops.*

EFFECTS INDUCED BY THE PROBIOTICS ON ANTIOXIDANT POTENTIAL OF BLACKCURRANT BERRIES

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Abstract

The use of probiotic microorganisms can be the alternative to chemical fertilizers and can help to avoid harmful impact on crop quality and enhance the nutrient status of the plants by different mechanisms. Berries production is usually carried out using demand new quality standards. In this point, plant growth promotion probiotics could be a key tool toimprove their antioxidant characteristics. The blackcurrant (*Ribes nigrum* L.) berries present low energy contents and high antioxidant activity due to high concentrations of bioactive compounds such as vitamins, or phenolic compounds. The main aim of this study was to examine impact of probiotic preparations on accumulation of antioxidant compounds of blackcurrant berries, also the impact on overall amount of phenols, anthocyanins and vitamin C. High performance thin-layer chromatography method for quantitative estimation was used. The blackcurrant berries were collected on organic farms in 2017-2018. The impact of microorganism inoculant complexes ProbioHumus and NaturGel on the accumulation of antioxidant compounds in berries was evaluated. It was found that ProbioHumus significantly increased antioxidant activity to 56%, compared with 53% in the control berries, and anthocyanins content to 2.4 mg/g versus 1.7 mg/g in control, but did not have the influence on phenols and vitamin C accumulation. While NaturgGel enhanced the accumulation of anthocyanins to 2.9 mg/g, and vitamin C content to 2 mg/g versus 1 mg/g in control, it reduced antioxidant activity. Significant increase on antioxidant activity and anthocyanin level was observed by treating plants with both probiotic preparations in couple.

Keywords: *anthocyanins, ascorbic acid, probiotic preparations, Ribes nigrum.*

ORGANIC AGRICULTURE FOR ECOLOGICAL BALANCE: THE CASE STUDY OF NEPAL

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Abstract

Nepalese topography has the largest variations in altitude in the world, ranging from less than 88 m to 8848 m (The Everest), with the cultural diversity of 106 ethnic languages which are spoken within this country. Kathmandu, a historical and World heritage city is situated in central part of Nepal. Our research centre at Kakani is situated above 2000 meter height from mean sea level; we have developed organic farming widespread in more than 900 thousand square meter in area. We can see model of organic farming like sustainable agriculture practices, growing and selling the quality product of strawberry, rainbow trout fish, natural honey, and many vegetables. vOur another research centreis located at the height starting from 300 meters to 1300 metres from the mean sea level In Piple village.In the southern slope of Nepal Chepang, the economically backward ethnic communities live in the forest; livelihoods are based on agriculture, hunting, and wood collection etc, but they have a rich and unique cultural tradition. Physiologically Mongoloid featured Chepangs resemble the Kirantis. Their totems are dog and arrow according to the Tibeto-Burman group of languages. They observe all the Hindu festivals of Dashain, Tihar and Sakrantis besides their own tribal festival Nwagi, which is performed on a Tuesday during third week of Bhadra (some day in August and September). Now majority population of Chepangs follows the Christianity. Chepangs do not possess other artistic skills of any kind except weaving of baskets and leaf umbrellas which they use for protection against rain. Very few Chepangs are literate. There still persists a tendency among the Chepangs to avoid schooling. We are trying to uplift their living standard. This paper deals in depth with the different types of successful biomass energy production technologies from the human and cattle manure units and also empowerment of the diverse and indigenous community organizations based on the concept of self-reliance. This paper also deals with the eleven biogas and natural fertilizer-producing toilets constructed in this village for organic farming.

Keywords: *Biomass toilet, indigenous people economic empowerment, organic farming, Sustainable resource management.*

RESPONSE OF GROUNDNUT TO RHIZOBIUM INOCULATION IN TWO AGRO ECOLOGICAL ZONES OF NORTHERN NIGERIAN SAVANNAH

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Abstract

This experiment was conducted in Kano (Sudan savanna) and Bauchi (Guinea savanna) states of Nigeria in 2016 cropping seasons to assess microbial inoculants influence on groundnut yield in northern Nigeria. The experiment in each location was a randomized complete block design (RCBD) with seven treatments, replicated four times. Four rhizobia inoculants were tested on groundnut (SAMNUT 24) in the two agro-ecological zones to monitor their performance and ability to establish symbiotic relationship and nodulate groundnut. The treatments were Histick, Biofix, nitrogen, cattle manure, Histick + cattle manure, Biofix + cattle manure and control. Most probable number (MPN) method was used to assess the number of rhizobia cells in the inoculants used for the field experiment. Results showed that, the inoculants contained enough number of viable rhizobia strains to inoculate legumes. It was observed that, inoculated plots produced higher grain yield, even though not significantly different from the control. In the groundnut field, Biofix produced higher nitrogen fixed than all treatments in the Sudan savanna, while in the Guinea savanna no significant differences ($P = 0.67$) were observed between the treatments and the control. However, inoculated plots had higher nitrogen fixation than the control. Generally, the performance of Histick and Biofix inoculants were low under groundnut fields in both locations. This concluded that in groundnut fields there is little response in inoculants. However, Biofix performs better compared to Histick. It is recommended that farmers should use inoculants of high quality in combination with cattle manure for better yield.

Key words: *Nodule, Groundnut, Nigeria, Nitrogen and Inoculants*.

NITROGEN TRANSFORMATIONS AND MAIZE GROWTH IN RESPONSE TO NITRIFICATION INHIBITORS AND PEANUT STRAW BIOCHAR

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Abstract

The type/form of nitrogen (N) supplied from organic and inorganic sources influence soil exchange properties and crop growth. The urea induced acidity, while amelioration caused by peanut straw biochar (PB) singly or in combination nitrification inhibitors was assessed by growing maize under greenhouse. The UN amended with PB increased the pH, decreased soil exchangeable acidity and increased maize biomass. The pH increase corresponded to the biochar rate as maximum rise was observed at 2% PB either alone or in mixed application with 10 mg/kg dicyandiamide (DCD) and dimethylpyrazole phosphate(DMPP). The hydrolyzed ammonium from urea released protons on nitrification and caused drastic pH reductions, however, addition of DCD and DMPP retained NH_4^+-N and held responsible for maintaining high soil pH to some extent. At higher application rates of PB adsorption of NH_4^+-N improved the N retention which effectively ameliorated the soil acidity and improved N availability for plant uptake. Therefore, over single UN application addition of 2% PB combined with DCD or DMPP enabled almost a 3-fold increase in maize biomass. The articulated maize growth under PB and nitrification inhibitors showed superiority under DCD which was attributed to the potential of the biochar to increase N availability and increased soil pH, ECEC and base saturation(P<0.05). Hence, we found that sole urea application induced server acidification; however, if supplied with PB and nitrification inhibitors can increase soil pH, reduce exchangeable acidity, and improve soil nutrient status for sustainable maize growth under acidic soils environments.

Keywords: *ammonium N, biochar, maize growth, nitrification; soil pH; exchangeable acidity.*

CYANOBACTERIA-PLANT INTERACTION: ASSOCIATIVE NITROGEN FIXATION AND AUXIN PRODUCTION BY *LEPTOLYNGBYA* AND ENHANCED GROWTH OF *VIGNA RADIATA*

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Abstract

Being one of the oldest inhabitants on planet earth, cyanobacteria possess many mechanisms to interact with members of other life kingdoms. Their interaction with the plants is highly important. The main target of the present study is to study some mutual benefits of interaction between *Leptolyngbya* and *Vigna radiata*. The *Leptolyngbya* strain MMG-1 was isolated from the rhizospheric region. Auxin production and nitrogen fixation ability of the strain was measured in free form and after co-cultivation with *V. radiata* seedlings. Physical interaction between *Leptolyngbya* and *V. radiata* roots was studied by Confocal Laser Scanning Microscopy (CLSM). Cyanobacterial strain was used as seed and soil inoculants for *Vigna radiata* var. NM-92. Impact of cyanobacterial inoculations on the plant growth was evaluated under axenic and natural wire house conditions. The *Leptolyngbya* strain MMG-1 produced auxin in the presence of supplemented tryptophan in free form but in association with the roots, auxin was produced without tryptophan supplementation. Being non-heterocystous cyanobacteria, the strain MMG-1 showed nitrogen fixation in absence of light in free form, but in association with roots, its nitrogen fixation ability increased 100% and nitrogen fixation was also observed in light. Under CLSM, not only strong colonization of *Leptolyngbya* filaments was observed on the root surface, but also the penetration of filaments was observed inside the root cells. Over all seed inoculations appeared to be more effective than soil inoculations. The growth of *V. radiata* was significantly affected by the cyanobacterial treatment as compared to control. Seed germination under axenic conditions showed up to 40% increase as seed inoculation over control. The highest increase in plant length was up to 24%. Biomass, especially shoot dry weight, was significantly improved (up to 96%). Biochemical parameter (plant auxin content and total soluble proteins) was enhanced after cyanobacterial treatment. Inoculation of *V. radiata* also showed stimulation of shoot length, number of leaves, number of pods and grain weight up to 45%, 72%, 40% and 13%, respectively. Hence non-heterocystous cyanobacteria *Leptolyngbya* strain MMG-1 possessing multiple plant growth promoting traits can be used in fields as biofertilizer.

Keywords: *Leptolyngbya, Confocal Lase Scanning Microscopy, Nitrogen Fixation, Auxin, Vigna radiata.*

MYCORRHIZAL INOCULATION ENHANCED TILLERING IN FIELD GROWN WHEAT, NUTRITIONAL ENRICHMENT AND SOIL PROPERTIES

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Abstract

To meet food security, commercial fertilizers are available to boost wheat yield, but there are serious unhealthy effects associated with these fertilizers. Amongst various organic alternatives, inoculating crop fields with mycorrhizal species is the most promising option. Although, mycorrhizae are known to enhance wheat yield, but how the mycorrhizae influence different yield and quality parameters of wheat, is not clear. Therefore, this study was undertaken to investigate the influence of indigenous mycorrhizal species on the growth of wheat, its nutritional status and soil properties, in repeated set of field experiments. In total 11 species of mycorrhizae were isolated from the experimental sites with *Claroideoglomus,* being the most dominant one. Five different treatments were employed during the present study keeping plot size for each replicate as 6 x 2 meters. Introduction of consortia of mycorrhizae displayed a significant increase in number of tillers per plant (49.5%), dry biomass (17.4%), grain yield (21.2%) and hay weight (16.7%). However, there was non-significant effect of mycorrhizal inoculation on 1000 grains weight. Moreover, protein and carbohydrate contents were increased to 22.2% and 12%, respectively. Iron, Phosphorus and Potassium concentrations were increased to 21%, 30.9% and 14.8%, in response to mycorrhizal inoculation. Enhancement effects were also noted on soil fertility such as soil organic matter % age, available Phosphorus and Potassium were increased up to 64.7%, 35.8% and 23.9%, respectively. Herein, we concluded that increasing the mycorrhizal inoculum in wheat fields has remarkable effects on wheat yield/quality by enhancing tillering and soil fertility.

Keywords: *Mycorrhizae, Wheat, Claroideoglomus lamellosum, Funneliformis mosseae.*

SOIL AND ITS MICROORGANISMS: A CASE STUDY FOR SUSTAINABLE AGRICULTURAL PRODUCTION UNDER PAKISTAN'S CLIMATIC CHANGE CONDITIONS

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Abstract

Pakistan is 7th most vulnerable country to climate change. There is a dire need to manage the risks to sustainable agriculture in an environment threatened by climate change. Soil is a limited resource and stresses such as drought, salinity, and heavy metal are decreasing agricultural productivity day by day. Our aim was to check the potential of Plant Growth Promoting Rhizobacteria and various modified biomasses as effective soil amendment techniques for improving plants growth under predicted abiotic stresses of climatic change. Experiments were conducted to isolate and characterize stress tolerant Rhizobacteria, and to check their stress mitigation potential. Modified plant biomasses like compost, biochar, and bio-organic fertilizer were used as soil amendments techniques. Various morphological, physiological, biochemical, growth and productivity parameters were studied. Microbial strains were isolated from the stressed region. The identification of isolated microbial strains was carried out by physiochemical and 16s rDNA sequencing and phylogenetic analysis. Stress tolerance and different plant growth-promoting traits of isolated strains were evaluated under normal as well as in stress condition. Inoculation of seeds with PGPR along with compost, biochar and bio-organic fertilizer improved all growth and productivity parameters, increased nutrient status and improved osmolyte production and hence helped the survival and growth under stress conditions. Building our understanding of the interdependence of micro-organism communities, soil nutrient status and plant health will be important for understanding climatic effects on soil health and plant growth.

Key words: *abiotic stresses, climate change, PGPR, soil amendments.*

CONTENT OF SELECTED ANTIOXIDANT COMPOUNDS IN RAW MILK PRODUCED ON A CERTIFIED ORGANIC FARM AND IN YOGHURT MADE FROM IT

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Abstract

Milk is one of the main sources of antioxidants supplied to the body. The aim of the study was to assess selected antioxidant compounds (vitamins E, $D_3$and A, β-carotene, and whey proteins– β-lactoglobulin and lactoferrin) in raw milk produced on a certified organic farm and in yoghurt made from it. Two seasons of production were taken into account (spring/summer and autumn/winter). In the spring and summer the cows grazed in the pasture *ad libitum* and additionally received hay and cereal meal, while in the autumn and winter their diet consisted of grass silage supplemented with hay and cereal meal. A total of 10 bulk milk samples (5 from each season) were tested. The natural yoghurt was made by the water bath method in a laboratory, and a total of 30 yoghurt samples were tested. Reversed-phase high-performance liquid chromatography (RP-HPLC) was used to determine the concentrations of β-lactoglobulin, lactoferrin and selected vitamins (Varian liquid chromatograph, USA). The content of the compounds analysed was found to be high in both the raw milk and the product – yoghurt (despite pasteurization of the milk). The technological process significantly reduced the concentrations of the compounds in the yoghurt. They contained on average 1.10 g/l β-lactoglobulin, 37.60 mg/l lactoferrin, 1.783 mg/l vitamin E, 0.694 µg/l D_3, 0.412 mg/l A and 0.240 mg/l β-carotene. The greatest differences between the raw milk and the product were noted for β-lactoglobulin and lactoferrin (more than 50% lower in the yoghurts). The level of vitamin E was decreased by 15%. The raw milk obtained in the spring/summer was a more valuable source of the antioxidant compounds tested, which was translated to a high bioactive status for the product. The organic milk obtained in the study can be considered a valuable raw material for processing.

Keywords: *Organic milk, Yoghurt production, Vitamins, Whey proteins, Antioxidant properties*

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RESEARCH ON THE USE OF COVER CROPS FOR THE CONTROL OF DISEASES AND PESTS IN ORGANIC VINEYARDS

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Abstract

One new viticultural system capable of exploiting plant diversity was tested in the Murfatlar vineyard between November 2018 and September 2020. The experiment was set in a plot cultivated with Fetească neagră variety, in ecological system. The experiment plan consisted of four treatments, each having two sub-treatments: one treated according to the organic guidelines and the other untreated against pests and fungal diseases. The tested cover crops were a plant mix comprising *Lolium perenne* 50%, *Onobrychis* viciifolia 25%, *Trifolium repens* 25% (semi-permanent cover crops, mowed and mulched after flowering) and another mix represented by *Vicia sativa* 50%, *Sinapis* sp. 50% (mowed after flowering and incorporated into the soil) and *Tagetes sp.,* planted as seedlings under the vine row. The development of powdery mildew (as incidence and severity of symptoms on leaves and/or bunches) in the treatment with the plant mix *Vicia sativa* 50%, *Sinapis sp.* 50% made the degree of attack lower than the other treatments. On the other hand, the treatment with the plant mix *Lolium perenne* 50%, *Onobrychis viciifolia* 25%, *Trifolium repens* 25% showed mild forms of attack with *Plasmopara viticola*, *Guignardia bidwellii* and *Botrytis cinerea.* The treatment with *Tagetes sp*. had a repellent effect for the main pest of the vine, where *Lobesia botrana* registered the lowest numbers of captured adults and larvae on flowers and bunches. Regarding the production quality, the first innovative treatment obtained the best results both in 2019 and in 2020 (267 g/l and 262.8 g/l sugars respectively). Overall, there are no significant differences between the treatments in terms of grape production.

Key words: *Ecological vineyards, Plant diversity, Cover crops, Fungal diseases.*

VALORIZATION OF WINE AND MARINE BY-PRODUCTS AS POTENTIAL ORGANIC FERTILIZERS IN GRAPEVINE CULTURE

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Abstract

The objective of this study is to capitalize on marine and wine by-products in order to obtain organic fertilizers with applicability in viticulture. For this, green algae, brown algae, shells, fermented pomace, unfermented pomace and grapevine canes were combined in different proportions, resulting in mixtures that were applied in 2020, on an experimental field cultivated with the Feteasca neagra *Vitis vinifera* variety. The statistical results obtained regarding the effect of applied organic fertilizers showed, on the one hand, significant increases in biochemical compounds involved in the growth and development of vines, quality and grape production, and on the other hand, an improvement in soil quality, especially in essential nutrients, such as mobile phosphorus and potassium. Both nutrients recorded an average increase over 60% compared to the unfertilized control, classifying the soils in the category of those with very good nutrient supply. The combination of wine and marine by-products in the form of organic fertilizers is not only an effective alternative to chemical fertilization, but also a valuable tool for reducing the impact of pesticides on the environment. Given the results obtained in the first year of study, we will continue this experiment on fields grown with other red and white grapevine varieties for wine with Murfatlar Protected Denomination of Origin.

Keywords: *Grape pomace, Marine biomass, Biofertilizers, Harvest improvement.*

HUMIC ACIDS COMPOSITION OF ARABLE SOD-PODZOLIC SOIL AFTER LONG-TERM APPLICATION OF TRADITIONAL AND UNCONVENTIONAL ORGANIC FERTILIZERS

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Abstract

The elemental composition and structure of humic acids (HA) of arable sod-podzolic soil (Eutric Albic Retisols (Abruptic, Loamic, Cutanic) was studied in Perm Agricultural Research Institute – division of PFRC. Application of traditional and unconventional organic fertilizers was fulfilled in long-term stationary experiment. The carbon content in HA of sod-podzolic soil varied from 30.7 to 34.6; hydrogen – 28.9-35.5, oxygen – 21.1-27.9, nitrogen – 1.9-2.2%. The H/C ratio for all treatments was >1, the structure of the supramolecular associations of humic acids is predominantly aliphatic. Long-term use of manure, sewage sludge (SS) and their combination with mineral fertilizers led to the enrichment of humic acids with nitrogen. The maximum degree of HA oxidation was observed with the use of cattle manure. The FTIR spectra of humic acids had absorption bands of carboxyl, hydroxyl, methyl, methylene, methoxyl and other groups in a wide wavelength range. At 1720 cm^{-1}, an absorption band was recorded, which had a high intensity in the control variant and was due to oscillations of the >C=O group of carboxylic acids. With an increase in the load of the anthropogenic factor on the soil (application of organic and mineral fertilizers), a decrease in its intensity is observed. The structure of supramolecular HA aggregates of the control variant, with the introduction of NPK and unconventional organic fertilizer – SS, is characterized by a higher content of aromatic fragments, as evidenced by a clear existence of the absorption band at 1628 cm^{-1}. Cattle manure application promoted the formation of humic acids with a branched aliphatic structure.

Keywords: *element analysis, atomic ratios, humic acids oxidation degree, IR spectroscopy, fertilizers.*

MODELING OF THE PRODUCTION PROCESS OF SPRING GRAIN CROPS TO IMPROVE ORGANIC PRODUCTION IN URBANFARMING

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Abstract

The world's population is expected to grow to almost 10 billion by 2050, boosting agricultural demand – in a scenario of modest economic growth – by some 50 percent compared with the current situation. Economic growth and population dynamics are driving the structural change of economies. The decline in the share of agriculture in total production and employment is taking place at different speeds and poses different challenges across regions. The use of urban areas for the needs of agriculture keeps pace with the trend of organic crop production. In this work, author combined these areas and tried to create and test a suitable technology for obtaining an acceptable crop of grain crops (wheat and barley) and safe quality on field plots in Moscow (Russian Federation).

Key words: *modeling, food secutiry, agriculture.*

SMART LAND MANAGEMENT AND ORGANIC AGRICULTURE IN BELARUS

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Abstract

Organic agriculture is a system that, compared to traditional agriculture, has such major advantages in sustainable development as food safety and public health, as well as food security in general. Technologies used in the production of organic products provide, in particular, the abandonment of the use of agrochemicals, pesticides, antibiotics, growth stimulants, hormonal preparations, etc. An important role in solving this problem is played by the digitalization of agriculture and the creation of "smart land use" based on technologies of "smart land management". The development of the industry through such components as "smart field", "smart farm", "smart greenhouse", "smart garden", etc., should be considered in the overall system of functioning of an agricultural organization. The currently applied methods of assessing and planning productivity in organic farming systems should be based on a complex (systemic) multivariate analysis of relevant geospatial information in order to make operational and effective management decisions. Smart land management allows many tasks, such as: increasing the accuracy of estimation and forecasting of productivity in agriculture with almost 100% probability; significant increasing in the yield of agricultural crops and reducing production costs, for example, by automating the accounting of all factors of production of organic products; developing and implementing an effective system of anti-erosion and environmental protection measures for organic agriculture, etc. The agriculture of Belarus has high achievements both in the production of crop and livestock products. At the same time, the organic agriculture market is not sufficiently developed, so the article suggests measures to improve the situation in this area.

Keywords: *Organic agriculture, Smart land management, Organic food market, Belarus*.

CHARACTERIZATION OF COLORED MAIZE SEED FRACTIONS USING FLUORESCENCE SPECTROSCOPY AND MULTIVARIATE ANALYSIS

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Abstract

Application of fluorescence spectroscopy combined with chemometrics algorithms provides rapid and non-destructive screening method in seed quality estimation, widely used in the agricultural industry and crop breeding. Fluorescence spectroscopy is a technique capable of detecting differs fluorophores among various colored maize seed cultivars and through different seed fractions. In the present study, we used the Multivariate Curve Resolution-Alternating Least Squares (MCR-ALS) algorithm to analyse the excitation-emission matrices (EEMs) of various cultivars of colored maize (*Zea mays* L.) seeds and its fractions. The EEMs were recorded as a set, with the excitation ranging from 280 nm to 330 nm and the emission spectra ranging from 300 nm to 550 nm. The MCR-ALS analysis yielded two major fluorescence components for all of the analysed samples. Both position and shape of component 1 (C1) varied among the samples. On the other hand, the position and shape were similar for component 2 (C2). C1 could be used as a marker for the discrimination of colored seeds and their fractions. The observed variations in C1 between the analysed seeds may be due to the presence of their individual fluorophores, assigned to anthocyanins, proteins, and phenolics. In conclusion, the MCR-ALS analysis of the seed emission spectra has a great potential for the rapid and non-expensive characterization of various cultivars of colored seeds.

Keywords: *maize seed, fluorescence, Multivariate Curve Resolution-Alternating Least Squares.*

THE STATE OF ORGANIC GRAIN PRODUCTION IN SERBIA

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Abstract

Areas under organic plant production in Serbia have been permanently increasing. In 2019, of the total area under this type of production (21265.4 ha), the greatest share was under orchards (5324.4 ha), and cereals (21265.4 ha). Considering that organic cereal production has been growing continuously, the aim of this study was to show the range of areas under organic cereals in Serbia and to show the regional distribution for the period 2016-2019. Data were obtained from the Ministry of Agriculture, Forestry and Water Management of the Republic of Serbia. The following methods were used in the study: desk research, content analysis, comparative analyses and analyses of base and chain indices. The largest production of cereals was recorded in the region of Vojvodina (3914.3 ha), and then in the regions of southern and eastern Serbia (708.6 ha). In 2019, the organic wheat production was predominant (2264.9 ha), maize (481.6 ha) and silage maize (323.5 ha) ranked second and third, respectively, while the smallest area was under millet (only 3.3 ha). Considering that Serbia has exceptionally favourable natural conditions for cereal production, it is evident that natural potentials are not used enough, although needs for healthy, organic cereals in the world market are unlimited.

Key words: *organic production, cereals, areas.*

SOME INDICATORS OF ORGANIC PRODUCTS EXPORTFROM THE REPUBLIC OF SERBIA

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Abstract

The paper analyzes some indicators of exports of organic products in the Republic of Serbia in 2020. Our country exported 14,274 tons of organic products and the value of exports amounted to 37.45 million euros. In order to develop organic production, it is necessary to increase the area under organic production although they show a tendency of constant growth and in 2020 they amounted about 22,000 ha, but that is still insufficient given the great potential of our country. That is why Serbia should use the benefits at its disposal in order to become one of the leading European exporters of organic products, especially berry fruits. The paper uses the method of description, content analysis, comparative method, as well as methods of descriptive statistics.

Keywords: *Organic production, export, agriculture, Republic of Serbia.*

THE INFLUENCE OF ORGANIC FERTILIZERS ON THE SEED YIELD AND SEED QUALITY OF BUTTERNUT SQUASH (*CUCURBITA MOSCHATA*) GROWN ON DIFFERENT TYPES OF SOIL

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Abstract

Butternut Squash (*Cucurbita moschata*) is grown in Serbia on relatively small areas, despite its extraordinary nutritional properties that place it among the species with significant potential for the food industry. However, in the future, due to climate change, it is expected to expand its production in our country and region, primarily due to tolerance to high temperatures and drought, but also due to significant tolerance to diseases. In order to improve the technology of growing butternut squash in accordance with organic principles, a field experiment was conducted on the two soil types i.e. two different locations, with aim to investigate the effects of application of two different fertilizers on the seed yield and seed quality. Both locations are situated in the basin of the river Velika Morava, on two different types of soil (vertisol soil type and brown forest soil). At both locations, the pre-crop was corn and the applied agro-technical measures were in accordance with the principles of organic production. The average yield of Butternut Squash seeds varied from 678,1 kg/ha, as recorded on the brown forest soil, on the control treatment without fertilization to 918.75 kg/ha as recorded on the treatment with organic fertilizer NP 1 on the vertisol. Significant differences were also observed in seed germination which ranged from 84.67% in the control treatment on the brown forest soil to 98.33% as recorded in the treatment with the organic fertilizer NP2 on vertisol.

Keywords: *fertilizers, organic production, seed quality*.

DRY BEAN PRODUCTION IN THE FIRST DECADES OF THE 21ST CENTURY: REPUBLIC OF SERBIA

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Abstract

Beans (*Phaseolus vulgaris*) are used in the diet around the world and are a significant source of proteins, especially in lower-income countries. In recent years, their importance has been growing, especially due to its beneficial effects on human health and the global epidemic of obesity and diabetes. Worldwide, the average yield of beans has varied from 786 to 894.7 in the past ten years. In the same period, the areas under beans have varied significantly, but there is a gradual increase in arable land under this crop (30,685 thousand ha in 2010 to 33,066 thousand ha in 2019). In that period, there has been also an increase in production (from 24,775,394 t in 2010 to 2,8902,672 t in 2019). The paper analyzes the situation in bean production in the Republic of Serbia in the period from 2001 to 2020, as well as possible reasons for the observed trends. In that period, average yields varied over the years ranging from 808 kg/ha (in 2012) to 1294 kg/ha (in 2006) and can be explained by favorable and unfavorable temperature conditions. Despite the relatively good prices of beans, which varied from 0.99 to 1.35 USD/kg in 2004 to 2.23 to 4.12 USD/kg in 2014, depending on the size and color of the seeds, and possible profit, a significant decrease in the area under beans was observed (from 24,968 ha in 2001 to 8,512 ha in 2020) and a reduction in total production (30,927 t in 2001 to 9,253 t in 2020).

Keywords: *bean, production, harvested area, average yields.*

THE IMPORTANCE OF APPLYING ORGANIC PREPARATIONS IN THE PEPPER PRODUCTION

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Abstract

Pepper (*Capsicum annuum* L.), is one of the most important types of farmed vegetables. This plant is of huge economic significance in our country. It has been grown and used for a long time. The basic system of farming peppers is a conventional method of agricultural production which aims to achieve maximum production in both quality and quantity while keeping the expenses as low as possible. However, the conventional system has shown its disadvantages through adverse effect on peoples' health, the environment and its biodiversity. Organic production aims to produce safe food of high quality which production would be sustainable. The aim of this paper is to look into the possibilities, but first of all the advantages, of organic pepper production. Pepper is a very bold vegetable. It contains significant amounts of sugar, protein, minerals and vitamins. New technologies often have unintended consequences. High-yielding varieties, which require large amounts of water, artificial mineral nutrients and other agricultural chemicals, have caused environmental problems in many parts of the world. In some cases, high-yielding varieties have been shown to be less resistant to diseases and pests than traditional varieties. This requires greater use of pesticides, the excessive use of which has poisoned the soil and negatively affected biodiversity.

Key words: *peppers, agricultural production, organic production, high quality food.*

THE INFLUENCE OF SOME BIO-PRODUCTS ON GERMINATION AND PROTECTION OF *CHAMOMILLA RECUTITA* (L.) RAUCH SEEDS

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Abstract

The effects of six biological plant protection products, permitted in organic production ('Extrasol F', 'Polyversum', 'Timorex gold',' Vegard', 'Ozoneem trichul', 'EcoBooster Calcium'), in addition to two herbal preparations ('LAB 3' and 'LAB 4'), were examined on germination and seed quality of *C. recutita* cv. "Banatska". The aim of study was to discover the most effective bio-product with beneficial effects on quality and health of German chamomile seeds. Seed germination testing was conducted according to the standard procedure suggested by a Rule book on seed quality control, while the seed health was examined by the filter paper method. The seeds were treated with 15 ml of bio-product solution, while the same amount of distilled water was used as a control. The experiment was conducted in triplicates, and the seeds were observed on 14^{th} day following the treatment. In comparison to control, seed germination rate was increased in following treatments: 'LAB 4' by 11%, 'Extrasol F' by 9%, 'EcoBooster Calcium' and 'LAB 3' by 2%. Based on the symptoms observed on the seed surface, presence of *Alternaria* sp. was confirmed. Compared to control, the infection of seeds was reduced by 1% in treatments with 'Vegard', 'LAB 3' and 'LAB 4'. However, doubling the concentration didn't reduce infection but reduced germination in comparison to control. Since 'LAB 4' and 'Extrasol F' affected the most germination and to a certain extent prevented seed infection, both bio-products could be recommended for safe application on chamomile seeds.

Keywords: *German chamomile, germination and seed health, biological products, Alternaria* sp., *organic.*

IS THERE ANY EFFECTS OF ORGANIC FOOD ON HUMAN HEALTH?

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Abstract

In the last decade, the production and consumption of organic food have increased steadily worldwide. While there is increasing scientific evidence for biodiversity and environmental sustainability-related benefits of organic farming, there is still considerable scientific controversy about whether or not, and to what extent organic production methods result in food quality and safety, and human health gains. This review provides an update of the present knowledge of the impact of an organic versus a conventional food diet on health. Considering the nutritional value of organic products, the content of dry matter, minerals, vitamins and substances that give a better smell and taste of food, advantage is on the organic food side. In terms of the content of secondary metabolites of plants, products from organic production show significant advantages over products from conventional production. The content of polyphenols, carotenoids and vitamin C is 10-50% higher in products from organic production. The risk of food contamination by residues of pesticides and antibiotics is lower in organic than in conventional foods. Also, there is no evidence that there is a higher risk of microbiological and other natural toxins found in organically produced foods. Analyses of products from animal production, including milk, dairy products and meat, showed that products from organic production had significantly better characteristics compared to products from conventional production. This refers to the total content of useful fatty acids, especially the content of conjugated linoleic acid (CLA), the content of which can be higher up to 60% in milk from organic production, then a better ratio of omega-3 and omega-6 fatty acids, higher antioxidant content and lower concentrations of drug and hormone residues in organic products.

Keywords: *Organic food, Human health, Nutritional value, food quality and safety*

VARIABILITY OF PLANT HEIGHT AND SPIKE CHARACTERISTICS OF DURUM WHEAT GROWING IN ORGANIC PRODUCTIONS

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Abstract

The aim of this study is to investigate phenotypic variability of yield components for seven different durum wheat genotypes (Windur, Žitka, KG Olimpik, KG-28-6, KG-3405-03, KG-43-33-1, and KG-44-3-1), which were grown during two years (2012/2013 and 2013/2014) at certified organic trial located in Mršinci, the Municipality of Čačak, Serbia. The field experiment was conducted in a randomized block design with three replications with plot of 5 m² on the soil belonging to the loamy clay type. Experiment was carried out by the organic technology of farming production of durum wheat. For analysis of plant height and spike characteristics, 60 plants in full maturity stage were used (20 plants per replication). The primary tiller of plant was used for analyzed plant height, spike length and number of spikelets per spike. Plant height, on average, ranged from 76.0 cm (Olimpik) to 92.1 cm (KG-3405-03), spike length from 6.9 cm (KG-44-3/1) to 8.2 cm (Windur) and number of spikelets per spike from 19.3 (Žitka) to 22.5 (Windur). Variability for plant height was similar for both of years (CV=3.6%, 3.9%, respectively), but for spike length (CV=5.5%, 6.6%, respectively) and for number of spikelets per spike (CV=5.4%, 6.2%, respectively) was lower in the first than in the second year. Through variance analysis, a highly significant difference in mean values for all investigated components was established. Phenotypic analysis of variance indicated that ecological factors had higher impact in relations to genetic factors on expression of all three investigated traits.

Keywords*: durum wheat, organic production, plant height, spike characteristics, variability.*

EFFECT OF CROPPING SYSTEMS AND PLANT NUTRITION ON PRODUCTIVITY AND RHEOLOGICAL QUALITY OF WINTER WHEAT

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Abstract

The objective of this study was to evaluate the effect of cropping system (integrated-INT vs. organic-ORG) and plant nutrition sources (synthetic in INT vs. approved organic in ORG) on productivity, in-direct baking quality and rheological traits of winter wheat. The long-term field experiments were conducted on haplic luvisol developed at proluvial sediments mixed with loess. The elevation of experimental fields is 178 m a.s.l., the climate is continental, the average long-term (1961-2000) annual rainfall is 547.6 mm, the average long-term temperature is 9.9°C. The results after 16 years of field experiments were evaluated. Pre-crop for winter wheat was N-fixing crop. Grain yield of winter wheat (6.8 t ha^{-1} in INT; 6.5 t ha^{-1} in ORG) did not differ significantly, while plant nutrition sources had equal and positive effect on the yield. Crude protein quantity was higher in INT system by about 0.2%. The farinographdough development time and dough stability were the longest for ORG and fertilized treatments. Mixolab quality indicators showed clear distinction between ORG and INT systems and fertilization in the protein and starch characteristics of the grain. The ORG reported longer Mixolab stabilityof the dough, mainly on fertilized treatment (8.8 min). Starch characteristics – torque C4 (amylolytic activity) and torque C5 (starch retrogradation) were higher for ORG system. Torque C2, protein weakening, was not affected by cropping system. ORG system has the potential to achieve consistent, high quality yields with significantly lower reliance on external inputs.

Keywords: *organic system, winter wheat, yield, rheological quality*

Acknowledgement: This research was financially supported by the Ministry of education, science, research and sport of the Slovak Republic, project VEGA No. 1/0218/20.

PRODUCTION PARAMETERS AND ECONOMIC PERFORMANCE OF WINTER WHEAT GROWN IN ORGANIC SYSTEM

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Abstract

The objectives of the presented study were to evaluate the impact of two farming systems with different share of N-fixing crops, established on arable land (organic- ORG; integrated- INT), two fertilisation treatments (fertilised, unfertilised), three growing seasons, and their mutual interactions on the production parameters of winter wheat, and economic outcomes of its cultivation.On average, in integrated system, higher yield of winter wheat was achieved (5.1 t/ha) than in the organic one (4.9 t/ha), but the difference was not significant. Fertilisation and growing seasons appeared to have significant impact on the production parameters. The yield of winter wheat in ORG unfertilised treatment was significantly higher than in INT unfertilised one, as the result of higher share of N-fixing crops (50%) in ORG system. Synthetic inputs in INT system with 33% of N-fixing crops in crop rotation (fertilizers, herbicides) caused significantly higher yield of winter wheat compared to ORG - fertilised wheat. The economy of wheat production expressed as revenue was more favourablefor ORG system, when under the same realization price the revenue per hectare was in organic system 216.9 €/ha, and in INT system it was 124 €/ha. Including the subsidies from the first and second pillar of the CAP into calculation, the gap between the systems was even deeper, with the revenue of 576.1 €/ha in ORG and 330.2 €/ha in INT system. Taking into account the premium prices, the organic system can be 4.8 times more effective in terms of the economic results.

Keywords: *organic system, winter wheat, economic performance, production parameter.*

Acknowledgement: This research was financially supported by the Ministry of education, science, research and sport of the Slovak Republic, project VEGA No. 1/0218/20.

ALTERNATIVE FOR POLYPROPYLENE BAGS IN OYSTER MUSHROOM (*PLEUROTUS OSTREATUS*) CULTIVATION IN SRI LANKA.

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Abstract

The current practice for growing Oyster mushrooms (*Pleurotus spp.)* is in polyethylene bags. At the end of the cultivation period, polypropylene bags are thrown out, as bags cannot be reused for the next season. This practice causes serious environmental pollution in Sri Lanka. Therefore, this present study was carried out to introduce reusable wooden trays, plastic crates or glass containers and to identify a suitable container for substrate use for Oyster mushroom cultivation. The experiments were conducted at the mushroom unit in Matale. The experiment was laid according to Complete Randomized Design (CRD) using 4 treatments with 5 replicates. Treatments were polypropylene bags (T1), glass bottles (T2), wooden trays (T3) and plastic crates (T4). The substrates contained the department of agriculture (DOA) recommended ingredients. The results revealed that there was no significant difference between polypropylene bags and glass bottles on spawn running, pin head formation and biological efficiency (BE). Therefore, glass bottles can be recommended as a substitute for polypropylene bags than the wooden trays and plastic crates. Hence this study helps to reduce polyethylene waste accumulation and suggests substitutes for polyethylene bag to reduce polyethylene waste by providing environmental friendly containers for mushroom growers.

Keywords: *environmental pollution, mushrooms, plastic crates, reusable glass bottle, waste accumulation, wooden trays.*

USE OF ANIMAL DUNG FOR CULTIVATION OF OYSTER MUSHROOM (*Pleurotus ostreatus*) IN SRI LANKA

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Abstract

Growing Oyster mushroom (*Pleurotus spp*.) is popularizing among the rural community in Sri Lanka because it can utilize several plant-based residues. In Sri Lanka, the most popular substrate was sawdust substrate; plant-based residues. However, as yet, animal wastes have not been scientifically investigated to use as a substrate for Oyster mushroom cultivation, this experiment was carried out to find out the potential of using freely available animal dung in the substrate for the cultivation of oyster mushroom and to identify the suitable substrate for the production of Oyster mushroom to get better yields. This experiment was laid in a Complete Randomized Design (CRD) with 10 replicates in the grower's mushroom unit at Matale. The four treatments were, 9 kg of paddy straw +1 kg of dry cow dung (T1), 9 kg of paddy straw +1 kg of dry goat dung (T2), 9 kg of paddy straw +1 kg of dry pig dung (T3) and 10 kg of paddy straw (T4) (control). All treatment substrates contained the department of agriculture (DOA) recommended ingredients. The fastest spawn running, pinhead formation, first flushes, first harvesting and maximum yield was observed in (T2). It showed that the goat dung with paddy straw is a better substrate compared to the use of other animal dung, which has a great impact on growth and days to the first harvest. It suggests that strengthening the mushroom production by introducing potential locally available cost-effective substrates to minimize the production cost.

Keywords: *Dung substrate, Oyster mushrooms, Yield.*

ORGANIC FARMING AND POLICIES APPLIED IN TURKEY

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Abstract

Agricultural activities are among the current topics in every period. Agriculture is indispensable in terms of its contribution to community nutrition. It is important for people to live a healthy life and to improve their living conditions. Organic farming is known as environmentally friendly in respect of agricultural sustainability. It preserves the ecological balance as it is applied within certain rules. The aim of study is to assess the organic farming potential of Turkey. In addition, it is to examine the state supports applied in this regard. Organic farming started with intensive agricultural supports in the European Union and Turkey. However, it could not show rapid development in Turkey. Today, there are serious increases in the growing area and production amount of organic products. Organic farming method is applied for many products in Turkey. In recent years, it has increased especially in feed crops, grains and nuts. In addition to organic herbal products, organic animal products have also increased. The number of farmers involved in organic crop production was 53,782 in 2019. In addition, there are 170 farmers engaged in organic animal production in Turkey. Organic farming also has an important role in world trade. Turkey has an organic product export value of over $ 200 million in 2019. Producers and consumers should be informed about this. In the future, organic farming activities are expected to increase in Turkey.

Keywords: A*griculture, environment, health, sustainability, market.*

4.ENVIRONMENT PROTECTION AND NATURAL RESOURCES MANAGEMENT

BIODIVERSITY OF THE ENTOMOFAUNA OF AN ORANGERY IN EL-DJOUMHOURIA (EUCALYPTUS, ALGIERS)

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Abstract

Three sampling methods, those of Barber pots, mowing with a mowing net and knocking over a Japanese umbrella were used in the study of the entomofauna of an orange grove in El Djemhouria from September 2018 until July 2019. The total richness of the species trapped in 80 Barber pots was 142, divided between 5 classes of which that of Insecta (A.R. % = 93.5%) came first with the Hymenoptera (AR% = 80.2%) represented by *Tapinoma nigerrimum* (AR = 45.4%). Sampling using the mower net yielded a total richness of 109 species, belonging to 12 orders and 4 classes. Insecta dominated (A.R. % = 86.1%) with Diptera which came first with 29.1% represented by *Syrphus* sp. (A.R. % = 28.5%). Sampling using the Japanese umbrella concerned 130 species, belonging to 15 orders and 3 classes of which that of Insecta (AR% = 72%) occupied the first rank represented in particular by *Podurata sp.* (AR% = 24.6%) occupying the first position with the indeterminate species *Entomobryiidae* sp. and occurring with the highest frequency (A.R.% = 14.6%). By comparing these three trapping methods, we notice that each presents a precise order and domination, which explains the specificity of the latter. From this, we can deduce that these different methods are complementary.

Keywords: *Biodiversity, orange grove, Barber pots, mower net, Japanese umbrella, Eucalyptus.*

PARASITIC NEMATODES OF VEGETABLE CROPS IN SOME REGIONS OF MITIDJA (ALGERIA)

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Abstract

The intensification of market gardening, in particular in the Mitidja plain, has to deal with a large number of insect pests, diseases and nematodes recognized as a major constraint to production, in particular the genus Meloidogyne, which is more frequent and abundant in the plain. The study of the nematological population associated with market gardening was carried out during 2017/2018 campaign in two private stations in the Meftah region. The nematological analysis focused on 300 to 400 g of soil collected for each plot. Nematodes were extracted from the soil by the flotation and sedimentation methods. The inventory of phytophagous nematodes associated with market gardening in two stations of the Mitidja plain enabled us to identify the presence of 11 genera of nematodes: Meloidogyne, Globodera, Pratylenchus, Ditylenchus, Aglenchus and Xiphinema. Indeed, the numerous and abundant were Meloidogyne, Pratylrnchus, Ditylenchus, Tylenchus. The population densities and community structure of nematodes differred depending on the site of collection and the methods of sampling.

Keywords: *Inventory, vegetable crops, nematodes, Mitidja.*

EFFECT OF FUNGAL TREATMENT BY SOLID STATE FERMENTATION ON THE NUTRITIONAL VALUE OF OLIVE POMACE

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Abstract

Algeria is among the main Mediterranean countries producing olive oil, with a production rate of 45 thousand tons per year. The olive industry generates in addition to oil as the main product large quantities of appreciable by-products. One hundred kg of olive produce, on average, 100 liters of margines and 35 kg of pomace. In Algeria, these co-products are for the most part little or not valued and whose discharge into nature generates serious problems for the environment. However, their valorization would contribute to limit the impact of this industry on the environment.Thanks to their ability to use lignocellulosic feeds, ruminants can represent an interesting alternative for the valorization of olive pomace as livestock feed. The latter is, however, limited because of their low nutritional value due to their high lignocellulose content and low nitrogen content. The objective is to take advantage of the raw energy contained in this residue (4700 Kcal per Kg DM, of which nearly 50% at the membrane level); biological treatments would not only allow an improvement of the degradation of the parietal constituents of olive pomace, but also its enrichment in proteins. It is in this perspective that the present work is registered. We carried out a bioenhancement trial of the nutritive value of sieved spent pomace by the culture of a white rot fungus *Bjerkandera adusta* BRFM 1916 and we assessed its effects on the chemical composition (dry matter and parietal compounds contents) and cellulase digestibility of the DM.

Keywords: *Bjerkanderaadusta, cellulase digestibility, cell wall components.*

STUDY OF DROUGHT TREND AND ITS CORRELATION WITH NORMALIZED DIFFERENCE VEGETATION INDEX OVER SETIF REGION IN ALGERIA

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Abstract

The number of severe drought events and the drought duration are likely to increase. In particular, severe drought can have devastating effects. It is one of the most frequent climate-related risks occurring in Setif high plains region in Algeria. Numerous drought indices have been progressed over time and are variously performed throughout the literature. One of the popular and interest of meteorological drought is the Standardized Precipitation Evapotranspiration Index (SPEI). It is a multiscalar drought index based on climatic data. It can be used for determining the onset, duration and magnitude of drought conditions with respect to normal conditions in a variety of natural and managed systems such as crops and water resources. SPEI Trend analysis is conducted using nonparametric trend tests (Mann-Kendall and Sen's) for the time series in the period 1980-2020. The computed SPEI values showed statistically significant downward trend with Z test value of -2.66 and a Sen's slope of -0.015. A strong correlation was found between spring SPEI and Σ (March, April, May) Normalized difference vegetation index (NDVI), especially in the dry seasons, with a coefficient of determination R^2 varying between 0.49 and 0.99. However, these values decrease at 0.02 to 0.33 in the humid years. It can be concluded that drought continue to progress over time and constitute a real threat for rainfed crops (cereals) and water resources in the region. The high correlation between SPEI and NDVI indicates that Standardized- Precipitation–Evapotranspiration Index could be a good predictor of crop yield and vegetation dynamics.

Keywords: *Drought, Trend, Correlation, NDVI, Setif.*

CSR STRATEGIES OF INVASIVE WEED FLORA IN VINEYARDS OF BOSNIA AND HERZEGOVINA

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Abstract

Invasions of invasive species pose one of the greatest threats to biodiversity on a global scale. Because of that research on invasive species has recently been intensified, putting the focus mostly on studying invasive species and their habitats, determining impacts on indigenous species and communities, as well as options for controlling and countering proliferation. The problem of invasive species in Bosnia and Herzegovina is a relatively new area, considering that the List of Invasive Species was published only in 2019. The aim of this study was to list invasive species that occur as weed species in vineyards in Bosnia and Herzegovina and to expand the existing knowledge on CSR life strategies of invasive flora, combining the existing data from different sources as a whole, and determining the appropriate strategy for those species for which it is not known. At 73 vineyard locations, 27 invasive species were determined and their CSR life strategy was defined. Plant material necessary for the analysis was collected by field research in the area of vineyards in Bosnia and Herzegovina. The material is analysed and life strategies are defined on the basis of values of seven life traits (i.e. height, dry leaf mass, leaf dry matter content, onset and flowering period, lateral spread, specific leaf area). The most frequent type of strategy among the invasive flora of vineyards in Bosnia and Herzegovina is the CR strategy with 11 species and the C strategy with 9 species. Life strategy R is represented by 4 species and CSR with one species. With the increase of invasive alien species in vineyards, especially C and CR strategy plants, there is a high possibility of spreading these species to the surrounding ecosystems, natural and semi-natural vegetation, and thus seriously endangering biodiversity.

Keywords: *invasive species, CSR strategy, vineyards, Bosnia and Herzegovina.*

TEMPORARY AND PERMANENT WET ZONES IN BOSNIA AND HERZEGOVINA

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Abstract

The goal of this research is to examine the spatial distribution of temporary and permanent wet zones in Bosnia and Herzegovina (B&H). In addition, the research refers to changes that occurred in the period 2012-2018 using the Copernicus Water and Wetness (WaW) and CORINE Land Cover (CLC) database. Regarding water resources, B&H is one of the richest European countries, with total amount to over 10 thousand m^3/per capita/per year. The article also shows the vertical distribution of temporary and permanent wet zones. The European digital elevation model (EU DEM) was used to divide the territory of B&H into three altitude zones: from 0-500 m, from 500-1000 m, and over 1000 m. As the country is at the contact of the Pannonian Plain in the north, the Dinaric Mountains in the central part and the Adriatic Sea in the south, the impact of large natural regions on wetness area distribution is examined. The CLC database has been processed by extracting the wetland zones and calculating their spatial coverage and changes that happened during the period from 2000 to 2018. The research of WaW database shows that permanent wet areas occupy 0.1% and temporary wet areas occupy 2.5% of the B&H territory. According to CLC database wetlands cover 0.12% of the country's territory. So far, there has been no research on wetness zones based on the WaW high resolution layers database in B&H, which is the most significant contribution of this article.

Keywords: *Copernicus, Water and Wetness, regions, Bosnia and Herzegovina.*

WEED FLORA OF ARABLE CROPS IN HERZEGOVINA REGION (BOSNIA AND HERZEGOVINA)

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Abstract

This paper has studied weed population of arable crops in Herzegovina region (Bosnia and Herzegovina). On 34 research localities, overall 51 species of vascular plants from total of 25 families were noted. The highest share had family *Asteraceae* (counting 11 species) and *Poaceae* (counting 5 species). The analysis of biological spectrum of association *Panico- Portulacetum oleraceae* Lozanovski 1962. Terophyte-hemicriptophyte character could be determined, with slightly higher share of terophytes, and smaller share of hemicriptophytes, resulting exclusively from mechanical measures of weed control. In areal spectrum of association *Panico-Portulacetum oleraceae* Lozanovski 1962 seven groups of flora elements were asserted, among which elements of wide-spread dominate. Thirty two (32) plant species related to the cosmopolite group of flora elements. The stands of the *association Panico-Portulacetum oleraceae* Lozanovski 1962 in arable crops of Herzegovina contain 51 weed species, which represents a certain floristic wealth in relation to the eponymous association described in other localities. Special emphasis has to be set on species common for all localities, which are the typical species of syntaxonomic units (association, alliance, order and class): *Portulaca oleracea* L., *Echinochloa crus-galli* (L.) Beauv., *Setaria glauca* (L.) Beauv., *Amaranthus retroflexus* L., *Chenopodium album* L. and *Solanum nigrum* L. The most common type of strategy in weed flora is R (28.00%), followed by plants of CR strategy (16.00%).

Keywords: *weed flora, CSR strategies, floral diversity.*

PROMOTING THE APPLICATION OF SMART TECHNOLOGIES (CLOUD-BASED AND REMOTE SENSING) IN AGRICULTURAL WATER MANAGEMENT IN BOSNIA AND HERZEGOVINA

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Abstract

Project Promoting Smart Agricultural Water Management in Bosnia And Herzegovina - SMARTWATER project focuses on the promotionof smart technologies in agricultural water management in Bosnia and Herzegovina (BiH). The project is funded by the European Commission (EC) Twinning HORIZON 2020 program and it is coordinated by the University of Banja Luka (BiH). The project partners are: University of Sarajevo (BiH), Mediterranean Agronomic Institute of Bari (Italy), Consejo Superior de Investigaciones Científicas (Spain), Instituto Superior de Agronomia (Portugal), and SYSMAN PROGETTI & SERVIZI SRL (Italy). The main objective of the project is to reinforce networking, research, science and technology cooperation capacities of the University of Banja Luka, the University of Sarajevo and other connected BiH institutions, in the field of sustainable agricultural water management. The focus is on the capacity building ofthe early-stage researchers through their participation in a joint MSc program, advanced training courses, summer schools and hands-on workshops on R&I funding. The project foresees a large set of joint activities promoting networking, joint experimental fields, research cooperation and the exchange of knowledge and experts. The main topics treated by the project are the application of smart technologies (cloud-based and remote sensing) in agricultural water management, the optimization of the water–energy–food nexus, climate change impacts and adaptation measures. The scope is to enhance the research and technical competency of researchers and university staff, as well as the fund rising skills for a successful participation in the European Union (EU) Research Programs. The project has started in January 2021 and will last three years. The experimental fields are established near Banja Luka and Sarajevo with the aim to start with the monitoring of maize growth under different water and nitrogen treatments. In this context, different smart technologies will be applied to optimize use of resources and promote sustainable agricultural practices. The EU partners will provide technical assistance and expertise to improve the research and innovation capacities of BiH institutions and to delineate adequate research strategies and policies for the future. A modern scientific strategy for stepping up and stimulating scientific excellence and innovation capacity will be outlined following a multi-stakeholder participatory approach.

Key words: *HORIZON 2020, Capacity Building, Early State Researchers, Agricultural Water Management, Smart Technologies.*

ANTIBACTERIAL ACTIVITY OF MANUKA HONEY WITH DIFFERENT MANUKA FACTOR

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Abstract

Honey has been a part of myths and legends for centuries, gift from heaven, but also as the food of the Gods. The history of honey is as long and rich as the history of bees, which are one of the oldest forms of insects. To man, honey is the oldest food and known medicine. Manuka honey is the most researched medium and the first registered 'medical honey'. It is monofloral honey that comes from the nectar of the Manuka plant, *Leptospermum scoparium*, which grows like a bush or tree in New Zealand and eastern Australia. Phytochemicals derived from plants from which bees collect nectar or honeydew can have a beneficial effect on human health. Compared to other types of honey, manuka honey contains more flavonoids and phenolic acids that act as antioxidants and anti-inflammatory, antiproliferative and antimicrobial. Methylglyoxal (MGO) is up to a hundred times more abundant in Manuka honey compared to other types of honey and is considered responsible for its strong antimicrobial action. Manuka honey has different biological effects and wide application in complementary, but also in conventional medicine. It acts antimicrobial on a wide range of bacteria, including multidrug-resistant strains, thanks to its peroxide and non-peroxide activity. It is a powerful antioxidant, has anti-inflammatory, immunostimulatory, cytotoxic and antiviral, antifungal, and anthelmintic effects. The aim of this study was to examine the activity of Manuka honey of different unique Manuka factor (UMF) on bacterial cultures: *Escherichia coli*, *Staphylococcus aureus*, *Salmonella Enterica* and *Salmonella Typhimurium* and *β-hemolytic Escherichia coli* isolated from clinical material and to determine the type of action on these pathogens. The agar diffusion method was used by placing disks with a diameter of 9 mm on a solid sterile agar (Müeller-Hinton-agar-MHA) where 50 µl of honey (original honey and diluted samples in the proportion honey: deionized water 50:50 % and 75:25 %) was dropped with a micropipette. The results confirmed the antimicrobial activity of both Manuka honey on all tested bacterial strains with a range of 19.33 mm to 36.66 mm for Manuka UMF 5+ and a range of 21.66 mm to 34.66 mm for Manuka UMF 15+.

Key words: *antibacterial properties, manuka honey, pathogenic microorganisms.*

ANTIMICROBIAL PROPERTIS OF ESSENCIAL OILS AGAINST ESCHERICHIA COLI

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Abstract

Overuse and overprescribing of antimicrobial drugs and disinfectants both in veterinary and human medicine have resulted in bacterial resistance leading to the need for new antimicrobial drugs. One of the possible alternatives is the use of essential oils - aromatic liquids of oil consistency, which by different methods are extracted from almost all parts of plants. It has been proven that essential oils, to varying degrees have antibacterial activity, that depends on the type of bacteria and the type and chemical composition of the oil used. The aim of this work is to examine the antibacterial activity of essential oil of St. John's wort, mint, cinnamon, clover, rosemary, thyme, garlic, fennel, lemon and reference antimicrobial drugs to the growth of the bacteria *Escherichia coli*. Agar diffusion method was used to determine the antibacterial effect of essential oils and different amounts of essential oils were prepared by dissolving with 96% ethanol alcohol (1:1 and 2:1). The largest activity was demonstrated by essential oils of St. John's wort, mint, cinnamon and cloves while essential oils of rosemary, thyme, garlic and fennel showed slightly weaker inhibition depending on whether they were used as pure oils or combined with alcohol. Also, the type of action of essential oils is determined.

Keywords: *antimicrobial drugs, antimicrobial activity, Escherichia coli, essential oils.*

THE BULGARIAN MODEL OF LAND OWNERSHIP: THE "WHITE SPACE" PHENOMENON

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Abstract

More than three decades after the democratic changes in Bulgaria, the reforms in land use continue. In these transitional stages of development and reform of the institutional environment, globalization, and destructive competition, they continue to be a central topic of discussion and consultation among politicians, practitioners, analysts, researchers, and society. The paper aims to highlight the Bulgarian model of land use and land ownership, the phenomenon of "white space" and "blurring" of property. The phenomenon of "white space" has no formal definition. This concept has become necessary over the years in practice and the possibility of turning agricultural land into a "white space" is regulated in the Law on the ownership and use of agricultural land. Based on a regression analysis, the relationship between the change in the average prices of "white space" and the average land rental prices have been checked. The conclusion is that the average price of "white space" follows the change in the average rent, but with a delay that harms the owners. The phenomenon of "white space", a consequence of the "formal rules" of the institutional environment, creates conditions for concern among agricultural landowners.

Keywords: *landownership, property rights, "white* space*", Bulgaria.*

PLANT HEALTH FOR LOCAL CLIMATE REGULATION IN URBAN AREAS IN THE EASTERN RHODOPES

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Abstract

The regional dimensions of climate change are among the most serious challenges to the science-practice interaction for the protection of ecosystem benefits and human health. The region of Eastern Rhodopes in Southern Bulgaria stands out as particularly vulnerable area to climate change: a hilly and semi-mountainous region with traditional adjacency between landscapes of extensive agriculture and urbanized areas in a dense settlement network. This interdisciplinary study presents the results of a research of the cooling effect of green infrastructure in the urban space of Kardzhali in direct connection with plant health and the ecological status of water bodies. The research methodology includes several interrelated stages: identification of Urban heat island phenomenon, analysis of the temperature difference between green and gray infrastructure and thermal characteristics of green infrastructure elements; analysis and mapping of the plant health of urban and peri-urban vegetation as a prerequisite for providing ofecosystem services; assessment and mapping of the potential for the regulation of the local climate in the area of the town of Kardzhali. The results are aimed at sustainable management of green infrastructure in areas vulnerable to climate change and the development of adapted solutions for urban and suburban planning.

Keywords: *plant health, urban heat island, local climate regulation, green infrastructure, ecosystem benefits.*

Acknowledgement: This research is carried out within the project of the National Science Program "Environmental Protection and Reduction of Risks of Adverse Events and Natural Disasters", approved by the Resolution of the Council of Ministers № 577/17.08.2018 and supported by the Ministry of Education and Science (MES) of Bulgaria (Agreement № D01-230/06.12.2018).

RESPONSE OF YIELD AND QUALITY OF TOMATO GROWN IN UNHEATED GREENHOUSE TO IRRIGATION AND FERTILIZATION WITH DIFFERENT RATES

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Abstract

An experiment was conducted during 2020 on tomato variety Big Beef F1, planted in Haplic chromic luvi soil under drip irrigation with mulching and fertigation in an unheated greenhouse. The aim was to determine how the yield and quality of tomato were affected under full (100% ET_c) and deficit irrigation (60% ET_c) in interaction with four fertilizer rates (120% RDF, 100% RDF, 80% RDF, 0%). The total yield of tomato plants under full irrigation was 25.7% higher than the yield of the tomato plants under deficit irrigation. Full irrigation, in interaction with the fertilization rates 120 % and 100% RDF of NPK, maintained 30% higher yield of tomato than the yield of plants under reduced water supply with the same fertilization rates. The following parameters: total soluble solids, pH, reducing sugars, *ascorbic acid content* and titratable acidity were examined to assess the quality of tomato fruits. Except pH, all of the quality parameters of the tomato plants, subjected to moderate stress, due to a reduction in the irrigation rate, showed higher values than those of fully irrigated plants. The pH trend was reversed and the parameter had higher values at full irrigation. Analysis of variance (ANOVA) was performed to analyze the effect of irrigation and fertilization with different rates. The effect of fertilization on the yield and quality of tomato was less pronounced compared to the effect of irrigation.

Keywords: *Solanum lycopersicum, yield, quality, drip irrigation, greenhouse*.

ANALYSIS AND ASSESSMENT OF THE STATE OF BURGAS URBAN ECOSYSTEMS (BULGARIA) TO MAINTAIN NURSERY POPULATIONS AND HABITATS

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Abstract

Urban green infrastructure, being part of the larger system of urban ecosystems, provide an essential and proven benefits to the city dwellers, like health improvement, opportunities for nature-based recreation, strengthening sense of place etc. For a large part of the urban population, the green spaces are their only encounter with nature and species. These are current issues that deserve the attention of urban policy makers because the human's need of natural environment is expressed more intensely than in any previous period in history. The main objective of this research is to analyze and assess the state of the urban ecosystems to provide the regulating ecosystem service "maintenance of nursery populations and habitats". Functional urban area of Burgas, Bulgaria is selected for a case study. The assessment is performed by a composite indicator, reflecting the habitat functions within spatial units of urban ecosystems: population density, spatial urban development units, degree of fragmentation, share of protected plant and animal species, share of protected areas and representativeness of the natural heritage, presence of water bodies. The natural-social indicators are selected after a literature review on the topic. Some of them are adopted from the most common methodological framework for assessing biodiversity in urban environments - Singapore Index on Cities' Biodiversity. The results could support the urban planning and help to optimize the link between the green infrastructure within the FUA, providing ecological, economic and social benefits to the regions through the enhancement of the urban ecosystems functions and services, including the urban biodiversity.

Keywords: *regulating ecosystem services, urban ecosystems, green infrastructure, biodiversity.*

Acknowledgements: This research received financial support from the project „Game Over? Do not let the climate change end the game", contract № CSO-LA 2019/410-363of Bulgarian Biodiversity Foundation https://bbf.biodiversity.bg/en/.

ASSESMENT OF THE DIVERSITY AND DISTRIBUTION OF HONEY PLANTS BY HABITATS IN THE CENTRAL PARTS OF KRIVODOL MUNICIPLAITY (NORHERN BULGARIA)

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Abstract

Melliferous plants are key to the ecosystem pollination service. The melliferous plants are under strong anthropogenic pressure in the conditions of intensive agriculture and modern climate changes in southern Europe. The study is aimed at identifying and spatial distribution of honey plants species in traditional agricultural areas of northern Bulgaria: following the example of Vratsa district, Krivodol municipality. The study covers the period 2019-2021. Special attention is paid to the semi-natural and natural fragments in the landscape - headlands, hay meadows and pastures. The study presents the results of field observations conducted by the Braun-Blanquet method in 120 phytocenological descriptions of representative areas in the plain-hilly terrain. 14 habitat types according to the EUNIS classification have been identified and the projective cover and the number of honey-bearing species in habitats have been assessed, and the species with over 10% projective cover have been extracted and described. In the course of the research, landfills with invasive melliferous plants were visited and described. There is destruction of hay meadows and pastures and their conversion into arable land, which leads to loss of melliferous plants and habitats.

Key words: *melliferous plants, habitats, Northern Bulgaria, agricultural landscapes.*

OVERVIEW AND PACKAGE ACTIVITIES PERFORMED OF NATIONAL RESEARCH PROGRAM "ENVIRONMENTAL PROTECTION AND REDUCTION OF ADVERSE EVENTS AND NATURAL DISASTERS' RISKS"

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Abstract

The main goal of this paper is to present National Research Program "Environmental Protection and Reduction of Adverse Events and Natural Disasters' Risks", as well as the main activities carried out between December 2018 and May 2021 on work packages. This Program was approved by Council of Ministers Decision No. ДО1-363/17.12.2020 to No. 577 / 17.08.2018 and funded by the Ministry of Education and Science with Agreement No. DO-230 / 06-12-2018. The main activities are structured in two main work packages (WP): WP I - thematic (vertical) and WP II - horizontal (cross-cutting), which are divided into subpackages and scientific tasks. Under WP I - thematic (vertical) substantial work done on several databases ETCCDI, CECILIA, HadGeM2-ES including: species of insects that have been reported with severe attacks during the period 2003-2018, river outflow database at characteristic points of the Mesta River (and other rivers), an information matrix developed on the physicochemical status of surface waters in Bulgaria and others; a literary review on degradation processes in mountain soils (including soil erosion) and atmospheric pollution in forest ecosystems by difference factors; an analysis of the damage caused by hurricanes in Europe to forest ecosystems; the risk of penetration of dangerous invasive insect pests and pathogens into the forest ecosystems in Bulgaria, etc. The main sectors of the national critical infrastructure in the Republic of Bulgaria have been identified and recommendations have been formulated to optimize the sectors. Major problems of governance in the sectoral analysis process at national level have been identified; a critical analysis of Eurostat's data on renewable water resources, including for Bulgaria, has been made, a methodological framework for regional risk assessment (CRAF) has been adapted in two phases; a set of health indicators has been identified which, according to current scientific evidence, are relevant to the risk factors associated with the urban air environment (ambient air quality and meteorological parameters) and many others. Under WP II - horizontal (cross-cutting) was created and maintained website of the program https://nnpos.wordpress.com/; a program brochure has been compiled; posters of the program have been compiled in Bulgarian and English; National Research Program "Environmental Protection and Reduction of Adverse Events and Natural Disasters' Risks" has been presented at various scientific and public forums and many others.

Key words: *natural disasters, health risks, atmosphere, hydrosphere, lithosphere.*

UTILIZATION OF BOTTOM ASH FOR THE RECLAMATION OF DISTURBED TERRAINS

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Abstract

The present study presents the possibilities for the use of bottom ash generated during the burning of biomass - straw in the production of ethyl alcohol for the reclamation of strongly acidic mine soils. The ash is characterized by alkaline pH, high content of organic matter, total nitrogen, digestible phosphorus and potassium and trace element content. The ash shows hight potential for its use on acid soils. To prove this possibility, a vegetation experiment with different bottom ash content was performed. Vegetation experience shows that the addition of bottom ash leads to the neutralization of strongly acidic substrates, but at the same time leads to salinization with an increase in the percentage of bottom ash. The best results are shown by the plants grown in substrates with 5% bottom ash content.

Key words: *bottom ash, soil improver, reclamation.*

CHEMICAL COMPOSITION OF ESSENTIAL OIL OF WILD THYME GROWN ON SERPENTINE SOILS IN BULGARIA

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Abstract

In this study, the heavy metal concentrations and chemical compositions of the essential oils of wild thyme, growing on serpentine soils in Bulgaria were investigated. The content of heavy metals in aeral parts of wild thyme was determined by ICP. The oils were obtained from the aeral parts of the plant by hydrodistillation and analyzed by gas chromatography mass spectrometry (GC-MS) technique. Elevated Ni content does not affect the development of wild thyme and the quality and quantity of oil obtained from it. Forthy two components representing 98,35-98,85% of the total oil were identified. The major compounds were determined: germacrene D (14,97-17,11%), β-caryophyllenen (14,15-16,15%), sabinene (10,40-12,575), caryophyllene oxide (5,45-9,65%), cis-beta-ocimene (6,62-7,89%), trans-beta-ocimene (5,09-6,08%), β-selinene (3.15-3,76%), (-) -spathulenoln (3,18-6,54%), α-cadinol (3,00-5,51%), δ-cadinene (2,07-2,47%), α-humulene (1.95-2,33%), herpinene-4-ol (1.68-2,01%), and β-bourbonene (1,58-1,89%) in oils. The wild thyme can be considered as "excluder plant", containing relatively low metal concentrations in the aerial parts of the plants even in cases of high elemental concentrations in the soils. Metal concentrations for toxic elements in plants and oils were below the permissible limits for pharmaceutical purposes. Therefore, wild thyme found on serpentine bedrock is recommended to be collected for pharmaceutical purposes.

Key words: *serpentine soils, essential oil composition, heavy metals, wild thyme.*

Acknowledgements: The financial support by the Bulgarian National Science Fund Project KP-6-Austria/7 is greatly appreciated.

PARENT MATERIAL AS A KEY DETERMINANT OF SOIL PROPERTIES IN SOUTHERN PART OF NATIONAL PARK KRKA, CROATIA

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Abstract

Parent material is an important factor in soil formation, especially in soils formed in Mediterranean region dominated by calcareous sedimentary rocks. Their basic properties (mineralogical composition, coherence, and permeability for water) influence the resistance to weathering and type of weathering products, its amount, particle size distribution, as well as the intensity of physicochemical transformations within the original rock residue. Thus, the aim of this study was to investigate the impact of parent material on soil properties in southern part of Krka National Park, Croatia. Weathering of carbonate parent material (limestones, dolomites, conglomerates, marls) along with other soil forming factors was the base for soil development in this area. Thus, Calcocambisols and Terra rossa, typical and ilimerized are the most widespread soil types, while Calcomelanosols, Colluvium and Rendzinas are as well represented, but in much lesser extent. Soil depth, presence of coarse fragments and carbonate content in these soils vary considerably depending on parent material, although factors such as relief, vegetation and anthropogenic impact cannot be neglected. In general, shallow soils (< 35 cm) were formed on limestones and conglomerates, while medium deep soils (35-70 cm) were formed on marly substrates. The content of coarse fragments of variable size in soils (fine gravel 2-6 mm to boulders 60-200 cm) is related to different weathering processes of parent material. The presence of carbonate nodules on soil surface and within soil profile also indicates pedogenetic processes related to different types of carbonate parent material.

Key words*: Cambisols, carbonate rocks, soil depth, rock weathering.*

THE IMPACT OF LAND USE AND CLIMATE CHANGE ON EROSION PROCESSES AND THEIR MITIGATION FROM LANDSCAPE PERSPECTIVE

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Abstract

Soil is an integral part of the landscape and ecosystems. Agroecosystems cover about half of European land area. According to many reports, from a global perspective, generally, the soil is not in good condition, where a major threat is posed by accelerated soil erosion in particular. Soil erosion has become a focus of the EU's environmental agenda, mainly due to its impact on agricultural production, water quality, water retention, flood risk, biodiversity, carbon loss, and the provision of a range of ecosystem services. The presentation will analyse model examples of highly erosion-endangered areas of South Moravia, Czech Republic, where two main drivers of erosion, namely land use and climate change will be presented. The first driver has significantly influenced erosion processes within the Czech Republic and related ecosystem services, especially in the era of collectivization of agriculture, resulting in an intensification of erosion processes. The second driver, climate change, must also be taken into account, considering the predicted increase in rainfall erosivity. However, in the agricultural landscape, we must also address other issues, such as the landscape functional structure and biodiversity. The question arises as to whether these measures can be addressed comprehensively. The solution may lie in the use of two approaches – to support connectivity and provide erosion protection – in one functional unit. This approach will also be outlined in the presentation.

Key words: *agricultural landscape, water erosion, land use, climate change*

Acknowledgments: The research was supported by grants from the National Agency for Agricultural Research and the Technology Agency of the Czech Republic (QK1810233 and SS02030018).

EFFECT OF SELECTED ESSENTIAL OILS ON ACUTE MORTALITY OF *VARROA DESTRUCTOR*

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Abstract

Essential oils and their components are generally known for their acaricidal effects and are used as an alternative to control the population of the *Varroa destructor* instead of synthetic acaricides. However, for many essential oils, the exact acaricidal effect against Varroa mites is not known. The experiment was conducted using a glass-vial residual bioassay. Thus, the relative toxicity of 20 natural oils to *V. destructor* was evaluated. Each selected essential oil (0.375 µl) was dissolved in 500 µl of acetone and pipetted into 10 ml glass vial. Each essential oil was tested in 5 replicates. Subsequently, 5 vital mites were placed in each glass vial. Mite mortality was assessed after 2 and 4 hours. The highest mortality was observed in essential oils from Manuka, Cinnamon and Clovewhich showed 100% mite mortality as early as 2 hours after application. Despite high expectations, essential oils of Ginger, Turmeric and Pepper have proven to be significantly less effective. These oils did not kill even 50% of the mites 4 hours after application. The least effective essential oils were Coriander and Wormwood, which showed zero mortality even after 4 hours. Regarding to the results, effective essential oils have been selected for further testing, where their LC50 for mites and subsequently for bees will be evaluated.

Key words: *toxicity, glass-vial residual bioassay, acaricide, Varroa mite.*

RISK SPATIALIZATION OF AGRICULTURAL PHYTOSANITARY PRACTICES: CASE STUDY IN SOUTH-WEST FRANCE

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Abstract

Despite the political efforts, France is among the main consuming countries of pesticides in the world and the first at European level with a consumption of more than 85,900 tons/year (BNV-D[1], 2019). The preservation of natural resources through the management of diffuse pollution related to pesticide use is considered as a major challenge in France and based on the identification of the highest risk areas. Our work aims to map the phytosanitary practices impact on human health and on natural resources, based on indicators of phytosanitary pressure (TFI: Treatment Frequency Index) and risk (IRSA: Indicator of Risk on the Applicator's Health, and IRTE: Indicator of Toxicity Risk on the Environment). These indicators are calculated with the EToPhy[2] software. This approach allows to present the spatial distribution of risk and phytosanitary pressure in the south-west of France (Gimone watershed). This mapping process is based on the scores of phytosanitary pressure and risk assigned to each plot, calculated from the applied dose of pesticides and their toxicity degree. The spatialization of the health and environmental impact of farmers' phytosanitary practices enable us to identify the plots that represent the highest risk and their location to natural resources such as streams. The result could be used to improve the management of agricultural phytosanitary practices, taking into account the proximity of treated plots to different natural resources.

Keywords: *Risk, phytosanitary practices, spatialization, indicators, natural resources.*

[1] **BNVD:** National Bank of Plant Protection Sales by approved distributors, https://bnvd.ineris.fr/

[2] **EToPhy software (2020)**, APP deposit n°: IDDN.FR.001.090003.000. S.P.2020.000.31500. developed by CIHEAM-IAMM https://etophy.fr/

ETOPHY: WEB PLATFORM FOR MANAGING THE IMPACTS OF PLANT PROTECTION PRODUCTS USED IN AGRICULTURE

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Abstract

ETOPhy is a web application/platform which aims to assess and control the impacts related to the phytosanitary products used in agriculture on the environment and on human health. The ETOPhy web platform is presented as a dashboard to determine the phytosanitary footprint of agricultural phytosanitary practices based on indicators of phytosanitary pressure (TFI: Treatment Frequency Index), and of risk (IRSA: Indicator of Risk on the Applicator's Health, IRTE: Indicator of Toxicity Risk on the Environment). These risk indicators break down into acute and chronic IRSA and IRTE sub-indicators for terrestrial invertebrates, birds, and aquatic organisms. This tool provides two web applications to improve the management of pesticide use related risk to the applicator's health and to the environment for professionals involved in the management of plant protection products (PPPs): (I) ETOPhy *Simulateur* aims to assess the toxicity degree of PPPs and to find alternatives that are less harmful according to the crop and pest to be treated, (II) ETOPhy *Analyses* makes it possible to analyze the health and environmental impact of farmer phytosanitary practices at different scales (product, field, crop and farm). The phytosanitary pressure and risk indicators have enabled us to analyze the impact of plant protection practices and to compare the cropping systems of conventional, integrated and organic agriculture.

Keywords: *EToPhy web platform, human health, environment, indicators, plant protection products*

NUTRITIVE VALUE OF RIPARIAN COMMON REED BIOMASS FOR RUMINANTS

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Abstract

The extensive reedbeds, especially *Phragmites australis,* that spread around the perimeter of the lake Mikri Prespa, a Ramsar protected lake in the northwest of Greece, serves beneficially for several human activities and wildlife needs. Nevertheless, the apparent overgrowth and removal of this vegetation is often problematic and imposes difficulties in management and increases costs. Recent research is focusing into the use of *P. australis* as an alternative or complementary feed for ruminants. The aim of the present study was to evaluate the nutritive value of *P. australis* biomass derived from the riparian vegetation as a potential animal feed. Biomass samples were collected from six different sites of the Mikri Prespa lake in two different time periods (i.e. early August and late October 2020). The samples were analyzed for macro- and trace elements, total protein, NDF, fat and nitrogen-free extracts. Location and sampling date had a significant effect on all macronutrient concentrations with significant reductions in the second sampling period**.** For the trace elements zinc, copper and boron higher concentrations were observed in August, while the concentration of iron increased significantly in October. Dry matter and NDF content of *P. australis* was particularly high, 67.08% and 46.3% respectively; while protein content was rather moderate (8.38%, August sampling) to low (5.06%, October sampling). The results show that the nutritive value of *P. australis* is comparable to feeds widely used in ruminant nutrition such as wheat straw or marc, indicating a potential use as an alternative or complementary coarse feed with appropriate administration or treatment.

Keywords: *Reed beds, P. australis, Quality characteristics, Ruminant nutrition.*

ASSESSING THE POTENTIAL USE OF GFS-ANL MODEL WEATHER DATA IN FIELD-SCALE PRECISION AGRICULTURE IMPLEMENTATION

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Abstract

Implementation of precision irrigation (PI) approaches requires accurate meteorological data to estimate the evaporative demand of the atmosphere and thus the potential crop water needs. Consequently, extensive networks of meteorological stations are needed if such practices are to be integrated within farmers management practices. However, the establishment of such networks are costly. Free meteorological forecast models (e.g., global forecast model, GFS) can be used as an alternative free source of data. These models, except from a weather prediction for the next days, offer databases with historic meteorological data based on re-analysis (e.g., GFS-ANL). Nevertheless, their spatial resolution of 0.25×0.25 degrees (~ 28×28 km), is quite large and questions the reliability of the obtained data. In this framework, data from three weather stations located within the water district of Thessaly in central Greece and the corresponding GFS-ANL time series were collected. The parameters that were obtained were air temperature, wind speed, relative humidity and precipitation. Successively, a statistical analysis was performed to evaluate the model capability to simulate satisfactorily the measured weather data. The results indicated that the GFS-ANL model could simulate the air temperature quite fair (R^2 ~0.97; RMSE < 1.77 °C), but that was not the case for the rest or the parameters.

Keywords: *irrigation, precision agriculture, weather model, reference evapotranspiration.*

MOLECULAR CHARACTERIZATION OF GREEK SWEET CHERRY LANDRACES (*PRUNUS AVIUM* L.) USING MICROSATELLITE MARKERS

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Abstract

Sweet cherries, *Prunus avium* L. (Rosaceae), are gaining importance due to their perenniallity and nutritional attributes beneficial for human health. A harmonized approach to characterization is key for an optimal utilization of germplasm in breeding. Fourteen sweet cherry landraces were finger printed using nine microsatellite (SSR-Simple Sequence Repeats) markers to assess their genetic diversity and relatedness. The nine primer pairs detected nine loci and revealed an allele richness of 5.111 (average alleles per locus), an expected heterozygosity (He) of 0.642, and a Shannon index of 1.269 among the landraces. This level of genetic diversity is comparable to previous reports in cherries. A great level of genetic diversity was observed in landraces cultivars, indicating that sweet cherry landraces are valuable for germplasm collection. All landraces were unambiguously identified based on multi-locus genotypes. Seven private alleles were detected among this collection. Principal Coordinate Analysis (PCoA) analysis separated the 14 landraces into 3 distinct groups. The results provide accurate genetic information for defined acquisition policy in the repositories, improving the integrity and efficiency of germplasm management and giving evidences for protection of breeder's intellectual rights. The present study is part of the national Greek research project ‘‘Eco-Variety” (T1EDK-05434) which focuses on the collection, molecular characterization, conservation, propagation, evaluation, and sustainable utilization of local varieties of fruit trees that are traditionally cultivated or neglected/abandoned, as well as with Greek native forest fruit trees and shrubs.

Keywords: *Greek sweet cherries, Genetic diversity, Microsatellite markers, Abandoned fruit trees.*

DECISION SUPPORT SYSTEM FOR WASTEWATER AND BIOSOLIDS SAFE REUSE IN AGRICULTURAL APPLICATIONS

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Abstract

Since the appearance of humans on the earth, various wastes started being produced, such as human or animal solid or liquid excreta and liquid or solid wastes produced by man's domestic, agricultural, and industrial activities. Today, vast quantities of wastewater and biosolids are being produced the world over, and they are either disposed of in the surface water systems or accumulate in the soil, causing environmental problems. Both the wastewater and biosolids contain valuable constituents such as water, plant nutrients, organic matter (OM), and energy. Safe reuse of treated wastewater and sludge in agriculture could reduce the inorganic fertilizers usage, decreasing unexploited rejected wastewater and sludge, contributing sustainably to the environment. However, the decision-making for safe and rational reuse of wastewater and sludge is a complex task. A computer-aided Decision Support System (DSS) contribution seems to offer an attractive solution for safe reuse and effective management of the effluents mentioned above. The present work describes such a DSS developed by the HOU Laboratory of Sustainable Waste Management Technologies. To demonstrate the DSS function based on the reuse of wastewater and biosolids, two examples are given of reuse of treated municipal wastewater (TMW) and biosolids, one with low nutrient content and a second with high nutrient content. From the DSS reports, it is concluded that by using wastewater and biosolids with higher nutrient concentrations, considerable gains, up to 100% of nutrients are achieved.

Keywords: *wastewater, sludge, biosolids, safe reuse, decision support system.*

SOIL INORGANIC NITROGEN AND COTTON YIELD SIMULATION USING THE CropSyst MODEL: A PRELIMINARY CASE STUDY IN GREECE

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Abstract

Agricultural management practices on fertilizer nitrogen are vital to soil sustainability and crop productivity, as well as to reducing global greenhouse gases and environmental pollution. An increasing number of models have been adapted for specific purposes and scales of application which may lead to better understanding of crop response under different environmental conditions and management practices in agriculture. One of the greatest challenges is the capability of models to simulate adequately crop growth and soil nitrogen dynamics under different management practices. Among the crop simulation models that have been developed over the last decades, CropSyst model was selected for the present study. CropSyst (Cropping Systems Simulation Model) is a multi-year multi-crop simulation model developed to study the effect of cropping systems management on productivity and environment and has been widely used to simulate the growth of several crops with generally good results in many parts of the world. The objective of this study was the evaluation of CropSyst model's ability to simulate the soil inorganic nitrogen and cotton production in two locations in Greece, Larissa (central Greece) and Orestiada (northern Greece). The simulated results were compared with the measurements of soil inorganic N and crop yield of the two experimental fields throughout the growing season. It is concluded that the amount of soil inorganic nitrogen as well as the cotton yield were generally simulated well for both locations, indicating an overall satisfactory model performance. Hence, CropSyst model can be an important tool in agricultural research to assess the environmental impact and agronomic benefit of fertilizer N applications to irrigated areas.

Keywords: *CropSyst Crop Growth Simulation Model, Soil nitrogen simulation, Cotton yield.*

POTENTIAL FOR REUSE OF THE DRAINAGE WATER IN HYDROPONIC CULTIVATIONS OF TOMATO PLANTS

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Abstract

The use of hydroponic cultivations for groceries (e.g. tomatoes, peppers, cucumbers) has increased lately. However, in most cases, the reuse of water drainage is avoided, as it contains large numbers of pathogenic microorganisms, which threaten the health of the crops and of the consumers. The present study examined the potential for the reuse of drainage water from hydroponic cultivations using continuous UV radiation systems. Irrigational effluent water was collected from two hydroponic tomato plant greenhouses (I & II) in Rethymno, Crete, Greece. The experiments were carried out next to the greenhouses, using a continuous flow portable UV-C disinfection system, with cell volume 0.5 L, lamp power 10 W and radiation wavelength 254 nm. The relative radiation intensity was calculated as 38 mW/cm^2. Before disinfection, the water was filtered. The CFU of Total Coliforms (TC), *Escherichia coli* (*E. coli*) and Enterococci were determined on petri dishes, at the original water sample and at selected time intervals (between 0-45min), for irradiation conduct times between 0-45s. The conduct time was controlled with a peristaltic feeding pump. The concentration of nitrogen and phosphorus, before irrigation and at the greenhouse effluent were also determined to estimate the potential savings in fertilizers due to water reuse. The experimental results indicated similar disinfection behavior for greenhouses I & II: at 30s conduct time for both greenhouses, TC were reduced by 99.38±0.13 and 99.16±1.2, respectively, for *E. coli* by 98.3±0.45 and 98.0±4.0, respectively and for Enterococci by 93.5±0.41 and 96.75±0.12, respectively. Almost complete disinfection was achieved at 45s irradiation conduct time: the disinfection efficiency was measured about 99.93 for Entrerococci and about 99.99 for TC and *E. coli*. Assuming irrigational water transmissivity 50% and lamp aging factor 80%, it is concluded that the UV disinfection dose for almost complete disinfection of hydroponic irrigational water is about 400mJ/cm^2.

Keywords: *UV, disinfection, water reuse, hydroponic, greenhouse, tomatoes.*

VULNERABILITY ASSESSMENT OF SOIL SALINIZATION BY IRRIGATION WITH SALINE WATER. APPLICATION IN THE COASTAL AREA OF RHODOPE, NE GREECE

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Abstract

The water scarcity has led to a significant decline of water table in many coastal aquifers of the Mediterranean basin. This has also led to salinization of groundwater reserves due to seawater intrusion, which will eventually affect the irrigated agricultural land due to salt accumulation by irrigation with saline waters. To cope with this problem, MEDSAL Project (www.medsal.net) aims to evaluate the vulnerability of soil to salinization by irrigation with saline waters through its intrinsic ability to leach salts via water percolation below the root zone with the aid of precipitation. The specific approach is based on the existing formula LOSW-P, which evaluates the precipitation water losses by percolation below the root-zone of 30 cm from a theoretical reference crop surface considering soil physical properties, topography and mean long-term climate conditions. The application of LOSW-P was performed for the Rhodope pilot area of MEDSAL project, as well as all for the total of irrigated lands in Greece. The results showed that ~80% of irrigated lands (including Rhodope) present LOSW-P values <100 $mm \cdot year^{-1}$ (only through precipitation), which are relatively low considering that these regions require irrigation rates >600 $mm \cdot year^{-1}$. At least for the case of Greece, the proposed methodology of the MEDSAL project indicated that the use of water with relatively higher salinity may not be a solution to most irrigated lands (including Rhodope coastal area) and further solutions shall be evaluated.

Keywords: *soil vulnerability to salinization, MEDSAL project, Greece.*

SUSTAINABILITY YIELD INDEX AND YIELD TRENDS OF WHEAT CROP IN LONG-TERM FERTILITY EXPERIMENT UNDER MAIZE-WHEAT SYSTEM

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Abstract

Sustaining crop production has become a major concern in agriculture in many parts of India. The present study aimed to examine the long-term effect of fertilizers and amendments on yield sustainability and to determine yield trends over the years in an on-going long-term fertilizer experiment at experimental farm of CSKHPKV Palampur (HP) under maize-wheat cropping system in silt loam soil classified as "Typic Hapludalf". The long-term yield data of wheat crop (1972 to 2019) was used to study sustainability yield index (SYI) and yield trends. The highest (0.40) and the lowest (-0.05) overall SYI values were found in 100 per cent NPK + FYM and 100 per cent N, respectively. Annual wheat yield trend ranged from -4.72 to 0.078 per cent per year. The rate of yield change varied significantly and was negative for all the treatments, except control (0.078%). 50 per cent NPK (-0.45%), 100 per cent NPK+ lime (-0.75%) and 100 per cent NPK+ FYM (-1.04%) were at par with each other. The balanced fertilization recorded lesser decline in grain yield as compared to imbalanced fertilization. The overall yield decline observed with continuous cropping over the years might be probably due to the decline in the essential and beneficial nutrients which were not supplied through fertilizers, climate change and declining soil pH.Thus, it may be concluded that the integrated application of inorganic fertilizers and organic manures (FYM) significantly improved the SYI and yields as compared to imbalanced fertilization.

Keywords: *Sustainability yield index, Long-term, Wheat, Yield trend.*

BHILWA (*SEMECARPUS ANACARDIUM*) - IMPORTANT TREE

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Abstract

Semecarpus anacardium, commonly known as the marking nut tree, phobi nut tree and varnish tree, is a native of India, found in the outer Himalayas to the Coromandel Coast. It is closely related to the cashew. Semicarpus anacardium is a moderately sized deciduous tree, reaching up to a height of 12-15 meter and girth of 1.25 meter. Bark is rough, dark brown in colour. Leaves are large, simple, obvate-oblong and 9.0-30.0 cm long, curvaceous covered with five pale pubescenc. Bhilwa is also called as Biba. It is important tree species from researchers' point of view. Seeds are helpful for skin diseases, they have anticarcinogenic properties, nutrient rich floweris helpful to balance diet. Godambi that is endosperm of seed is rich source of nutrient. Therefore, for tribes this is important tree species to fulfill their daily needs.

Key words: *Bhilwa, Biba, medicinal tree, arid species*.

EVALUATION OF WINTER WHEAT YIELD USING SATELLITE IMAGERY

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Abstract

Estimating biomass or crop yield can improve farm management and optimize precision agriculture applications. Satellite data provides good information from the farms. In this regard, this research was aimed at finding a fast method with acceptable accuracy in order to predict the yield of winter wheat by using NDVI and LAI indices on the five farms located in Neyshabur, Khorasan Razavi province. The MODIS images of the TERRA satellite were conducted during the years 2012-2013 to 2014-2015. The results showed that there was a high correlation between NDVI and LAI indices (88 to 99%) over the years. The correlation between the observed performances with the LAI index varied between 2012-2013 and 2014-2015 so that in some years there was a strong correlation and in some years, a weak correlation. The correlation coefficient between observed wheat yield and NDVI index was 85.63, 15, and 48% in 2012-2013, 2013-2014 and 2014-2015 respectively. Results showed that vegetation indices changed in different fields and at different times during the growing season, so that the trend of changes in the indexes increased with approaching June and then decreased with approaching the wheat harvest time. Based on the results of this study, the sum of squared errors (RMSE) for the 10 calibrated farms was calculated to be 1.38 ton/ha, and the total squared errors (RMSE) was validated for 5 farms equal to 1.45 ton/ha. Based our results, wheat yield can be well predicted using regression between vegetation indices in flowering and filling stage and yield using regression analysis.

Key words: *Yield estimation, Remote sensing, Leaf area index, Normalized difference vegetation Index.*

CLIMATE CHANGE AND FOOD SECURITY: A REVIEW ON CHALLENGES AND OPPORTUNITIES FACED FARMING SYSTEMS IN ARID REGIONS

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Abstract

Climate change and variability may have an impact on the occurrence of food safety hazards at various stages of the food chain. It may also affect socio-economic aspects related to food systems such as agriculture, animal production, global trade, demographics and human behavior which all influence food safety. There is also concern that meeting the rising demand for food is leading to environmental degradation thereby exacerbating factors in part responsible for climate change, and further undermining the food systems upon which food security is based. A major emphasis of climate change/food security research over recent years has addressed the agronomic aspects of climate change, and particularly crop yield. Therefore, while agronomic research alone cannot address all food security/climate change issues, hence the balance of investment in research and development for crop production vis a vis other aspects of food security needs to be assessed. Improved understanding of the impacts of climate change on crop production helps to develop adaptation options, and also crucially it improves understanding of the consequences of different adaptation options on further climate forcing. This role can further be strengthened if agronomists work alongside other scientists to develop adaptation options that are not only effective in terms of crop production, but are also environmentally and economically robust, at landscape and regional scales. Furthermore, such integrated approaches are much more likely to address the information need of policy makers. The potential for stronger linkages between the results of agronomic research and the policy environment will thus be enhanced.

Key words: *Food Systems, Environmental Variability, Adaptation Strategies.*

ENERGY CONSUMPTION AND FOOD PRICE: A QUANTILE REGRESSION APPROACH ON IRANIAN DATA

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Abstract

Energy and agriculture sectors play a key role in Iran's economy as the former provides considerable share of public budget and the latter contributes significantly in employment, non-oil exports and food self-sufficiency. Iranian government is following energy subsidy targeting policy in order to increase energy (especially exhaustible ones) efficiency. This will, obviously, influence (among others) energy price and consumption, cost of production and finally food price. So, current study has focused on the nexus between energy consumption and food price in Iranian agriculture. Since it's believed that such relation may differ as consumption varies, the quantile regression model is applied and estimated using data for the period 1966-2017. Main findings revealed the direct and significant impact of energy consumption and globalization index on food price in the 0.75^{th} quantile while exchange rate showed same effect in 0.25^{th} and 0.75^{th} quantiles. Furthermore, money supply was explored as another driver for food price in all quantiles.

Keywords: *Energy Consumption; Food Price; Quantile Regression; Iran.*

NEXUS BETWEEN ENERGY CONSUMPTION AND AGRICULTURAL INFLATION: IRANIAN EXPERIENCE

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Abstract

Agriculture is recognized as a key economic sector in Iran as it provides approaximately10, 23, 21 and 85 percent of GDP, national employment non-oil exports and food security, respectively. Moreover, Iran is among countries highly subsidizing energy. The purpose of this paper is to examine an empirical method and identify the possible linkage between energy consumption and commodity prices in the context of Iran's agriculture. To this end, different linear and non-linear models are estimated using the quarterly data over a 26-year span from the second quarter of 1991 to the first quarter of 2017. Our results confirm the asymmetric impact of energy consumption shocks on agricultural commodity prices. According to the results of the Markov switching model, agricultural prices respond negatively to any shock from energy consumption whereas, the effect of energy consumption on agricultural commodity prices in the high inflation rate regime is less than the low inflation rate regime. The empirical evidence indicates that the probability of remaining in the high inflation rate equals 93%, which is more than alternate regime, and the agricultural inflation rate is low and high in 36 seasons and the 63 seasons, respectively. Besides, the paper found that there is an asymmetry in the agricultural price volatilities due to the fact that most of the coefficients have been changed by changing the regime. Gradual removing of energy subsidy as well as designing non- price support policies (direct and deficiency payments, improving total factor productivity) are recommended.

Keywords: *Agricultural Prices, Energy Consumption, Markov - Switching Autoregressive Model, Iran.*

THE REMEDIATION POTENTIAL FOR PAHS OF *VERBASCUM SINUATUM* L. COMBINED WITH AN ENHANCED RHIZOSPHERE LANDSCAPE: A FULL-SCALE MESOCOSM EXPERIMENT

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Abstract

A full-scale mesocosm study was conducted to investigate the ability of plant (*Verbascum sinuatum* L.) - microbial consortium (fungi and bacteria) combination (which constituted our treatment) for the remediation of Polyciclyc Aromatic Hydrocarbons (PAHs) contaminated soil from Bagnoli brownfield site (west of Naples, Italy). We employed soil from three sub-areas (A_3, A_4 and A_6) characterized by different levels of PAHs contamination. Not-treated soils constituted the control mesocosms. Our results indicated a significant PAHs decrease after 240 days in all the three investigated soils. After the experimental time, less than 35% of Pyr, Chr, BkF and DaiP were remaining in the A3 mesocosm soil. As regards A_4, soil there was an outstanding removal rate of Pyr and DahP (up to 83%) decreasing from an initial concentration of 4.32 and 1.93 mg/kg to a final one of 0.73 mg kg and 0.31 mg/kg, respectively. Concerning A_6 soil, 68% of total PAHs was removed, and 6-rings compounds were drastically decreased. Our findings showed an enhanced PAHs removal in soil with lower pollution and cation exchange capacity. Overall, the enhanced microbial degradation pathways could mainly explain the PAHs decrease. Soil enzyme activities trend over time and microscopic evidences proved a rising associations between plant and microorganisms. The treated soil also highlighted an enhanced population of genes responsible for degrading PAHs. Microbial co-metabolism, helped by the establishment of complex relationships with hosting plant, demonstrated to intensify the synergistic effect especially for the degradation of HMW PAHs and represents a biotechnology with great prospects.

Key words: *Phytoremediation, Soil pollution, Polycyclic Aromatic Hydrocarbons, Microbial consortium, Mycorrhizal Symbiosis.*

BIOMASS-WASTE DERIVED PROTEIN HYDROLYSATES THROUGH PROTEOLYTIC ENZYMES IMMOBILIZED ON BIOPOLYMERIC SUPPORTS

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Abstract

The use of enzymes in the industrial field, especially in their immobilized form, has grown enormously in recent years. By virtue of their specificity and ability to work under mild conditions of temperature and pHs, enzymes can be used to regulate several kinds of processes. Immobilized enzymes have been taking hold in many industrial applications such as the treatment of biomasses obtained as waste products of the agribusiness and food industry. The recovery of the protein component in these biomasses proves extremely alluring for energetic purposes, as it provides protein hydrolysates, which represent high value-added products. In this light, the aim of our work is the immobilization of proteases from *Aspergillus oryzae* on a versatile and multifunctional biopolymer. The enzymes were covalently immobilized on bi- and three-dimensional formulations of the biopolymer through a procedure based on functionalization and activation steps to enable the binding of enzymatic molecules to the support. A biochemical characterization of the system, *i.e.* stability to temperature and pH variations, and physical characterization, carried out by Scanning Electron Microscopy (SEM), Atomic Force Microscopy (AFM), and Raman Spectroscopy, were performed. Moreover, the stability of the enzymatic activity over time and the ability to hydrolyze waste materials derived from oilseed crops were evaluated. A laboratory-scale continuous-flow bioreactor was also developed by using a three-dimensional formulation of the polymer, obtained by a 3D printer. This bioreactor was used to test the degradation of waste biomasses and the recovery of high added-value products containing small peptides and free amino acids for possible applications as nutritional supplements.

Keywords: *Immobilized Enzymes, Protein Hydrolysates, Waste Biomasses.*

SUSTAINABLE USE OF PLANT PROTECTION PRODUCTS IN *NATURA 2000* AREAS: MITIGATION OF IMPACTS AND BIODIVERSITY CONSERVATION

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Abstract

Natura 2000 is a network of areas stretched across European countries that ensures the conservation and safe of peculiar species and natural habitats. In Lombardy (Northern Italy), 87.475 hectares of farmland lie in *Natura 2000* areas. Here, agriculture impacts mitigation and biodiversity conservation represent a challenge. *Directive2009/128/EC* establishes a framework to achieve a sustainable use of Plant Protection Products (PPPs) by reducing their risks and impacts on human health and the environment. The DEMO-FARM project aims to set up a demo-farm, in the Natura 2000 area, in which to apply, in rice and corn crops, the principles of sustainable use of PPPs and carry out demonstration and information activities aimed at mitigation of impacts from pesticide drift and runoff, biodiversity conservation and ecosystem services implementation (*National Decree 10/03/2015 - Guidelines for the reduction of PPPs use in Natura 2000 sites; Regional Decision 11/03/2019 - Guidelines for the application in Lombardy of the National Action Plan for PPPs sustainable use*). Mitigation measures include: buffer strips (grassed and not treated), vegetative barriers, voluntary complementary measures supporting the creation of not treated buffer strips around farmlands for the conservation of species of Community interest, paddy margins sowing with native species. The demonstration and information activities carried out in the DEMO-FARM project want to strengthen the awareness that a significant reduction of risks associated with the use of PPPs is compatible with the need to ensure effective protection of agricultural crops, especially in areas with high environmental value.

Keywords: *Project DEMO-FARM, Biodiversity conservation, Agriculture sustainability. Drift and runoff mitigation, Lombardy.*

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PLANT-SOIL-MICROBIOTA COMBINATION FOR THE REMOVAL OF TOTAL PETROLEUM HYDROCARBONS (TPH): AN IN-FIELD EXPERIMENT

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Abstract

The contamination of soil with Total Petroleum Hydrocarbons (TPH) may rise dramatic consequences and need great attention and soil rehabilitation would need more efforts under a sustainable perspective. The potential worst-case of TPH contamination reflects soil affected by heavy industrial activities such as oil refinery. Adaptive biological system dynamics can play a key role to understand and address the potential of situ-specific biological combination for soil pollutants removal. Therefore, the experimental trial was conducted on 2,000 m^2 area from a contaminated site located in northern Italy. We evaluated the remediation potential over time (270 days) assessing (*i*) the phytoremediation efficiency of two species of Poaceae (*Festuca arundinacea* Schreb. and *Dactylis glomerata* L.) and two species of Fabaceae (*Medicago sativa* L. and *Lotus corniculatus* L.), (*ii*) the role of the indigenous bacteria flora and endo-mycorrhizae consortium addition in Plant Growth Promotion and (*iii*) induced resistance to contamination stress in a field experiment. Thirty-three indigenous bacteria selected form the contaminated soils showed marked plant growth promotion. Moreover, functional metagenomics confirmed the metabolic capability of hydrocarbondegrading microorganisms living in the polluted soil. Our data showed that soil enzymatic activities increased with hydrocarbon degradation rate after 60 days. Both Poaceae and Fabaceae resulted in remarkable remediation potential. Stress marker and antioxidant activity indicated that the selected plant species generally needed some time to adapt to TPH stress. Our evaluation implied both the rhizosphere effects and functional features of the plants.

Key words: *soil contamination, plant growth, northern Italy.*

MIXED MICROBIAL AND THERMAL DEGRADATION OF AGRICULTURAL DERIVED PLANT WASTES

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Abstract

The agriculture and food industries produce plenty of waste biomasses which need to be disposed of. In fact, these biomasses can be processed to produce high-value-added bio-derived products to be reintroduced into the market. A non-exhaustive list of these biotechnological commodities includes protein-hydrolysates (consisting of bioactive peptides and amino acids), growth-stimulating fertilizers for plants, and nutritional additives for animal feed. In all cases, a hydrolysis step is necessary to transform wastes into commodities. Hydrolysis is commonly performed by resorting to chemicals under extreme pH and temperature conditions. This approach results, however, are unfavorable because of the possible production of toxic side-products, and the high level of energy required, which makes this process eco-unfriendly. Another possible strategy is based on the employment of enzymes, which are nonetheless more expensive and, in the case of animal-derived products, need harsh chemical treatments to prevent the presence of prions. In light of these limitations, we have designed and developed a mixed procedure, applicable to both animal- and plant-derived wastes, based on a microbial preliminary degradation, followed by a mild thermic treatment. In this study, we degraded agricultural biomasses with a series of microbial combinations –a natural and synthetic microbial consortium and single species inoculations. In the case of processes aiming at producing fertilizers and plant growth factors, the microbial treatment produces a primary lysis and enriches the biomass with new microbial proteins. Finally, the mild thermic treatment contributes to complete this degradation, increasing the product homogeneity and killing all residual microbes.

Keywords: *Agriculture Waste Biomasses, Protein Hydrolysates, Thermal Hydrolysis, Microbial Hydrolysis, Mixed Hydrolysis.*

EFFECTS OF A MICROBIAL CONSORTIUM ON *SCHEDONORUS ARUNDINACEUS* IN A PLURICONTAMINATED SOIL

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Abstract

Soil contamination is becoming an emerging threat in recent years due to a significant increase in anthropogenic activities. For this reason, soil remediation strategies need to be implemented. In order to improve the remediation process with nature based solutions (such as phytoremediation) we have engineered the rhizosphere of *Schedonorus arundinaceus* (Schreb.) of Dumort using the mixed inoculum "MICOSAT F FITO WP" (*Glomus, Rhizophagus*, *Pseudomonas*, *Trichoderma*, *Pichia).* From 5 to 15 mg of mixed inoculum were added to 250 mg of sterile and non-sterile pluricontaminated soils. Germination rate (in the first 20 days) and agronomic parameters (at 40, 60, 90, 120 days) were evaluated. Chlorophyll and carotenoids were extracted and quantified at the end of the experimental period (120 days). Finally, the roots were observed under an optical microscope to assess possible interactions with microorganisms in the rhizosphere. The germination rate and the chlorophyll and carotenoid content of *S. arundinaceus* showed an increase in all treated samples, in the sterile and non-sterile soil, compared to the controls. The length of the roots and the aerial part was greater than controls. Fresh and dry weight were also higher in treated plants and they increased as the amount of the microbial inoculum used increased. Optical microscope observations showed an enhanced fungal colonization of treated roots. The treatment of *S. arundinaceus* with MICOSAT F FITO WP resulted in an improvement of all analyzed plant parameters, which may lead to a better plant performance for phytoremediation purpose.

Keywords: *phytoremediation, rhizosphere, soil contamination, bioaugmentation.*

PERFORMANCE OF A PILOT-SCALE CONSTRUCTED WETLAND SYSTEM AND REUSE OF TREATED WASTEWATER IN AGRICULTURAL IRRIGATION

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Abstract

In recent years, climate change has greatly affected rainfall and air temperature levels leading to a reduction of water resources in Southern Europe. Agriculture has been hit hard by the fall in water supply and a negative impact on irrigated crops has been observed. The treated wastewater (TWW) reuse for agricultural irrigation can represent a solution for farmers, allowing to reduce the consumption of freshwater (FW) and the need of mineral fertilisers. In the rural environment, constructed wetland systems are the most promising nature-based solutions to obtain TWW. This paper reports a two-year study on the wastewater treatment performance of a pilot-scale horizontal subsurface flow system in Sicily (Italy) and the effect of two sources of irrigation water (FW and TWW) on tomato plants and soil characteristics. The system had a total surface area of 100 m^2 and was planted with giant reed and umbrella sedge. An experimental field of tomato was set up close to the system. Results highlighted a high pollutant removal efficiency (RE) of the system. In particular, RE levels of *Escherichia coli* was found to be higher than 85% on average. The production and qualitative parameters of tomato fruits were significantly affected by the different irrigation treatments. The total yield of fruits was higher than 70 t ha^{-1} in the TWW-irrigated plots. Microbial contamination was high in fruits which were in contact with bare soil. The source of irrigation water did not vary the chemical composition of the soil. Our findings confirm that TWW provides an additional water source and nutrients where the supply of FW is limited.

Keywords: *Constructed wetland*; *Treated wastewater reuse; Tomato; Savings.*

IN VITRO METHANOGENIC FERMENTATION INHIBITED BY DIFFERENT EXTRACTS OF *HYPOESTES FORSSKAOLII* (VAHL) R. BR. (ACANTHACEAE) LEAVES

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Abstract

The increase of greenhouse gases is a critical issue. Recently, plant extracts have led to the interest as new, safe and inexpensive way to reduce ruminants' methane emission. *Hypoestes forsskaolii* (Vahl) R. Br. (Acanthaceae) is a perennial herb widely distributed in several African and in Arabian Peninsula countries where is used popularly as a natural insecticide. Plants belonging to *Hypoestes* genus are the main source of fusicoccane, isopimarane and labdane diterpenes together with phenolic compounds. The main biological activities reported for the fusicoccanes are antimicrobial and cytotoxic effects. As preliminary study, the effect of *H. forsskaolii* leaves extracts on *in vitro* rumen fermentation was evaluated. The n-hexane, $CHCl_3$, $CHCl_3$:MeOH (9:1) and MeOH of leaves extract were used. A ruminant diet (Forage: Concentrate ratio 60:40, CP 15 and NDF 36 % DM) was incubated as Control and with 1.0 mg of each extract at 39°C, under anaerobiosis with buffered rumen fluid, according to the *in vitro* gas production protocol. After 24 hours of incubation total gas produced (GP_{24}, ml/g), degraded organic matter (OMD, %) and CH_4 (% of total gas) were determined. The differences between the extracts were statistically tested (JMP, 14). Compared to the control, the addition of hexane and chloroform extract significantly ($P<0.01$) reduced GP_{24} and OMD,while CH_4 production decreased significantly ($P<0.01$) when n-hexane extract was added, probably due to the compounds present. The data obtained indicate that *Hypoestes forsskaolii* can modify the methanogen bacteria activity and can contribute to contain environmental impact. Further studies are needed.

Keywords: *natural bioactive compound, gas production, organic matter degradability.*

PROTEIN AND AMINO ACID PROFILE ANALYSIS OF AGRI-FOOD WASTE BIOMASSES

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Abstract

The degradation of biomasses derived from agriculture and food industry presents the double advantage of eliminating often-polluting wastes and giving the possibility to introduce novel bio-derived products into the market. The recovery of the protein component and its transformation into protein hydrolysates is generally carried out chemically and adds great value to waste biomasses. This strategy is extremely advantageous inasmuch as the high added-value bio-based products can therefore be reintroduced into the market in full compliance with the perspective of the Circular Economy. The products obtained can be used as food supplements both in human and animal nutrition, as growth stimulants in agriculture, or as biofertilizers. The peculiar characteristics of the protein hydrolysates obtained allow their multiple applications in many industrial fields. Therefore, this work aimed to assess the protein and amino acid (AA) profiles of agri-food biomasses, *i.e.* soy and cardoon wastes, previously subjected to hydrolysis processes. The protein profile of the initial biomass and that of the corresponding hydrolysate was analyzed by SDS-PAGE followed by Coomassie Blue staining, while the AA profile was evaluated by Quadrupole Time-Of-Flight Liquid Chromatography/Mass Spectrometry (Q-TOF LC/MS). The results indicate how the hydrolysis process breaks down the peptide bonds of the protein component of the biomass, leading to the formation of hydrolysates rich in free AAs and small peptides.

Keywords: *Protein Hydrolysates, Waste Biomasses, Circular Economy, Chemical Hydrolysis, Bio-Based Products.*

SUGGESTED SOLUTIONS FOR WATER PROBLEM IN LIBYA

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Abstract

The problem of water in Libya is caused by the increasing demand for fresh water. The groundwater supply is limited. The water supply will become more problematic with rapidly increasing population and low rainfall. After discovery of hug quantity of fresh groundwater in the deserts the south part of the country, the Libyan Government planned the Great Manmade River project. The Libya authorities designed and installed the hydraulic infrastructure needed to withdraw and transport this fossil water to various demand cites in the northern part of the country where most people live and majority of agriculture activities, Libya such as many Mediterranean countries, especially those in the south of the Mediterranean. facing by problem of the water because of population growth it is so high compare with north of Mediterranean countries. The problem of water – its quantity and quality as well – in the south is exacerbated further by the rapid growth of population, the competition among agriculture, industry and tourism sectors and the extension of irrigation and industrial development. Water scarcity a fundamental problem in Libya and most parts of the world Water shortage are often due to problems of uneven distribution and the management of existing Water supplies in Libya could be improved, Like most countries in the Middle East and North Africa, The Great Man-Mad River project was carried out to transport Fresh water from underground reservoirs in south Libya to more fertile and cultivable land where most people live, through a network of pipes that are buried at a depth of 7 meters under the ground, The pipe is 1.600 km long and its inner diameter is 4 meters, After the termination of all its network the pipes will be approximately 4.000 km long which make it the largest artificial irrigation network in the world The growth of Water demand has a marked impact on the water resources of Libya which suffered serious depletions and quality deterioration

Key worlds: *Mediterranean, Libya water problem, population growth.*

EFFECTIVENESS OF DIGESTATE FERTILIZATION ON SOIL MICROBIAL ACTIVITY AND GREENHOUSE GAS EMISSIONS

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Abstract

Agricultural wastes contribute significantly to global climate change through greenhouse gas emissions if not adequately recycled and sustainably managed. A recurring agricultural waste is livestock waste that have consistently served as feedstock for biogas systems. The objective of this study was to access the influence of digestate fertilization on soil microbial activity and greenhouse gas emissions in agricultural fields. Wheat (*Triticum spp. L.*) was fertilised with different types of animal waste based digestate and mineral nitrogen for two years. The 170 kg N ha^{-1} presented in digestates were split fertilised at an application rate of 90 and 80 kg N ha^{-1}. The soil microorganism activity could be predicted significantly using different sensitive monitoring approaches. The soil microbial biomass carbon was used to determine the organic carbon present in the living component of the soil organic matter. The emissions of greenhouse gasses (carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) were monitored directly by a static chamber system. The soil and environmental variables were measured to determine their influence on greenhouse gas emissions. Emission peaks were observed in N_2O and CO_2 after the first application of fertilizers with the emissions flattening out over the cultivating season, while CH_4 emission was negligible with no apparent patterns observed. Microbial biomass carbon was affected by the fertilized organic digestates. A significant difference was recorded between the control and the digestate treated soils for the microbial biomass carbon with lower activity observed in cow manure digestate when compared to other digestate treatment. Further results showed a positive response of microbial activity to digestate fertilization. The individual and cumulative emissions of CO_2, CH_4 and N_2O from the digestates were relatively low suggesting the digestate fertilization could be an efficient method for improving soil fertility and reducing greenhouse gases from agricultural sources in temperate climate conditions.

Keywords: *Carbon dioxide, Nitrous oxide, Manure digestate, Soil microbial biomass C.*

MODELING SUSTAINABLE ENTREPRENEURSHIP IN THE COVID-19 ERA

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Abstract

Anthropocentrism and ecoperiphery are two foundations that the present work used to specify a model for the study of sustainable local entrepreneurship. The differences between beliefs of scarcity and abundance of resources generate values, skills and knowledge that guide the undertaking of conservation or consumption of natural resources. A review of the Human Development problem, the theoretical and conceptual frameworks, as well as the most recent findings about social entrepreneurship allowed the specification of the relationships between the factors reviewed for discussion. Given that the documentary research allowed the discussion of two options for social entrepreneurship, one oriented to the conservation of nature and the other oriented to the exploitation of natural resources and the consumerism of public services, it was possible to anticipate study scenarios in those that the analysis of local and sustainable would start with perceptions, beliefs, values, knowledge and skills that make it possible to explain austere or consumerist lifestyles. The objective of this work was to specify a model for the study of sustainable entrepreneurship considering a review of the literature from 2019 to 2021. A cross-sectional and psychometric work was carried out with a sample of 450 coffee growers. A structure of three factors was found that explained 27% of the total variance, although the contrast of the model is recommended in other scenarios and samples.

Keywords: *Development, entrepreneurship, sustainability, anthropocentrism, ecoperiferism.*

GENETIC PECULIARITIES OF BROWN SOILS IN NATURAL AND ANTHROPOGENIC ECOSYSTEMS OF MOLDOVA

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Abstract

The genetic peculiarities of brown soils in the northern part of the Republic of Moldova were studied based on research of soil samples collected from profiles located in forest (natural ecosystem) and arable land (anthropogenic ecosystem). The research results showed that eluviation-illuviation (leaching), argillisation and humification were the main elementary solification processes leading to the formation of genetic horizons of brown soil profiles. The particle size composition confirms that the reduction of the clay content in the eluviation horizons (AEhţ, AEh, BEhtw) of the natural brown soil is much smaller than its accumulation in the illuvial-cambic horizons. This confirms the main role of the *"in situ"* alteration processes in the textural differentiation of the profile of these soils. Natural brown soils are characterized by moderate values of the index of textural differentiation, and arable soils - with weak values. The tillage followed by the destructuring of the arable layer led to the loss of its compaction resistance capacity; the humus content decreased 1.6-1.7 times; the apparent density at depth of 10-30 cm in the mid-summer reached very high values - 1.50-1.55 g/cm³, and the degree of compaction exceeded 20% (very compacted soil). As a result, the physical quality of this layer has become unfavorable for the growth of field crops. Positive changes as a result of the arable use of brown soils are: 2-3 times decrease in the value of hydrolytic acidity in the layer 0-30 cm; stopping the eluviation-illuviation process and the textural differentiation of the profile; accumulation in the arable layer of mobile forms of phosphorus and potassium.

Key words: *Brown soil, soil characteristics, natural and anthropogenic ecosystems.*

SOIL PROTECTION, AN ISSUE FOR AGRICULTURAL DEVELOPMENT: CASE OF MOROCCO

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Abstract

Land degradation decreases the ability of the ecosystem to provide goods and services for its beneficiaries. In the twentieth century, the phenomenon accelerated under the effect of increasing pressures and combined natural and anthropogenic factors. In 2019, the United Nations said the percentage of degraded soils was estimated at 33% and could reach 90% by 2050. In Morocco, more than 40% of the total area is affected by soil erosion due to deforestation, overgrazing, poor planting techniques and difficult climatic conditions, including long periods of drought and short periods of heavy rains. Thus, the protection of soils has become, in the context of increasing populations and climate change, a major challenge that humanity must meet. We believe that given the complexity and the exorbitant financial cost for the international community, the global effort must necessarily be joined by small actions at the local level as desired by the United Nations Food and Agriculture Organization of the United Nations. The purpose of this paper is to show, in the Moroccan context, how is it possible to make this FAO recommendation operational.

Keyword: *erosion, soil, agriculture, water.*

DESIGN AND STUDY OF AN INNOVATIVE PASSIVE SOLAR HEATING LAHOSYSTEM INSTALLED IN MULTI-SPAN GREENHOUSE

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Abstract

Greenhouse heating is an absolute necessity in winter season in order to keep air temperature inside the greenhouse above the good crop development conditions. The research of alternative clean energy sources for greenhouse heating has become nowadays more and more actual, due to high heating loads and the rising price of fossil fuels. Among the alternative energies to fossil fuels, the solar energy is the most cost-effective and viable to heat greenhouses in south Mediterranean basin. It is in this context that we have studied the performance of a passive solar heating system placed in Multi-span Moroccan greenhouse tomato crop, in order to assess the effect of such system on the microclimate and tomato yield. This passive heating system use water as heat storage and transfer fluid. The water is stored in black plastic sleeves positioned on both sides of crop rows near the roots. The surplus of solar energy is passively stored in the water during the day and released during the night. Comparison of results between two greenhouses (one equipped with the solar heating system and the other without) show that during the night, this system increased the greenhouse air temperature by a maximum of 3.9 °C and reduced the air relative humidity of the greenhouse by 8.5 %. This improvement in the microclimate in the heated greenhouse has led to an increase of the yield of fresh tomatoes by 30.7 % compared to the control greenhouse.

Keywords: *solar energy, solar heating system, greenhouse, tomato crop.*

AN ASSESSMENT OF THE PUBLIC-PRIVATE PARTNERSHIP POLICY AROUND AGRICULTURAL LAND IN MOROCCO

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Abstract

In agriculture, the Private-Public Partnerships (PPPs) have the potential to make a real impact. Agricultural PPPs combine the operational and economic efficiency of the private sector with the public sector's role as an enabling environment and regulator that ensures social interests. PPPs have the potential to modernize the agricultural sector and deliver benefits that can contribute to inclusive and sustainable agricultural development. Our contribution aims to make a brief assessment of the Public-Private Partnership around State agricultural land, to emphasize the benefits of this policy.With vast areas of uncultivated land and the youngest population in the world, Africa has the potential to feed not only its own continent, but much of the world. Growing population, increasing urbanization and mounting pressure on sustainable and ethical food production are transforming diets and the way food is produced. Against a background of limited government resources, innovative partnerships that bring together businesses, government and civil society are increasingly important for improving productivity and driving growth in agriculture and food sectors around the world. The public sector and the private sector have contrasting, but complementary advantages, when used together, great things can be achieved.Being competitive requires considering these changes and finding innovative ways to adapt to them. So the private sector has enough and best practices to apply in this sector or those PPPs are just a new form of privatization to involve more private companiesin all sectors.

Key words: *policy, agricultural land, Morocco.*

ENTREPRENEURIAL INNOVATION AND SUSTAINABLE FOREST MANAGEMENT: THE CASE OF IFRANE REGIONAL NATURAL PARK IN MOROCCO

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Abstract

The ecosystem fulfills multiple functions. Functions at the origin of sometimes contradictory management issues can generate, at the scale of a territory, conflicts between the actors. How to reconcile these issues and create the conditions for a sustainable territorial management of forests that is integrated and viable? This study is an attempt to answer this question. The aim is to mobilize an entrepreneurial approach to develop and validate innovative technical and organizational tools to promote multi-partnership and concerted forest management. The study took place in a test territory - Regional Natural Park of Ifrane- and focused on three major issues for sustainable forest management. This project aims to support and bring out green entrepreneurs who provide solutions to the sustainable, social, but also environmental issues of forests, through the creation of a system to fight against erosion and recover the humus formed around forest trees in order to use them as a natural fertilizer to regenerate the soil and restore soil fertility. This innovative technique has contributed to the improvement of ecological agriculture and the creation of 128 permanent jobs in the rural area of Timahdite. The ultimate idea is to gradually set up an entrepreneurial ecosystem. Our attention has focused on bringing out innovative tools adapted and built with the actors of the territory to bring out a shared and collective vision of forest management.

Keywords: *Entrepreneurial innovation, Sustainable solutions, Morocco.*

LABELING OF LOCAL PRODUCTS FOR LOCAL DEVELOPMENT AND PROTECTION OF BIODIVERSITY

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Abstract

The market for local products is growing all over the world. Small and medium-sized businesses investing in this area know they have tremendous strengths. And for good reason! Local products could meet the needs of consumers who are starting to question the safety of the current agro-industrial model and are increasingly tending to choose so-called "old-fashioned" products. Morocco relies on upstream and downstream to develop these natural products. Objective: to double agricultural GDP by 2025. Morocco is known for the richness and variety of its local products. These products, once labeled, constitute a promising opportunity for local development, because labeling helps preserve the national heritage, promotes product quality, strengthens the development of rural areas and improves the income of farmers. Our study focused on the role of the labeling of local products in the development of local socio-economic structures and the preservation of the biodiversity of these regions weakened by poverty and climate change. We conducted a survey of 68 cooperatives operating in the production of two far products for Morocco, namely saffron and argan. The results showed that the cooperatives which were able to obtain a Label (IG, AOP, LA) increasedtheir sales by more than 65%, while those which were not yet labeled were stagnant and even receding.

Keywords: *Labeling, Local products, Socio-economic development.*

INTEGRATED NUTRIENTS MANAGEMENT IN FIELD CROPS PRODUCTION: A BEST WAY FOR SUSTAINABLE SOIL MANAGEMENT IN CHANGING CLIMATE

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Abstract

Soil fertility, health and sustainability are continuously declining due to removal of essential plant nutrients from the soils in the current changing climate scenario. Low and high water and temperature stresses results in the deficiencies of essential plant nutrients, organic soil carbon and beneficial soil microbes that had negative impact on soil health, crop productivity and growers income globally. Integrated nutrients management not only increase crop productivity and growers income, but also increase soil fertility, health and sustainability in changing climates. Integrated nutrients management refers to the maintenance of soil fertility and improvement in crop productivity with application of plant nutrients through combined application of organic carbons sources (animal manures and plant residues), chemical and bio-fertilizers. The 4‰-Initiative aims to improve the organic matter content and promote carbon sequestration in soils through the application of agricultural practices adapted to local situations economically, environmentally and socially, such as agro-ecology, agroforestry, conservation agriculture and landscape management. Soil organic matter in soils plays a role in four important ecosystem services: resistance to soil erosion, soil water retention, soil fertility for plants and soil biodiversity. Stable and productive soils having sufficient amount of organic matter affect the resilience of farms to cope with the effects of climate change. Our long term field experiments on field crops e.g. cereals crops (rice, wheat & maize), oilseed crops (canola, sunflower & soybean) and grain legumes/pulses (chickpea, mungbean & mashbean) confirmed a significant increase in yield per unit area with integrated nutrients management under semiarid climates. The combined application of plant nutrients especially major nutrients (nitrogen, phosphorus and potash) along with different organic carbon sources (farmyard manure; animal manures: poultry manure, cattle manure, sheep manure, goat manure etc.; plant residues: onion residues, garlic residues, wheat residues, rice residues, chickpea residues, fababean residues, canola residues etc.) into the soil had significantly improved crop growth and increased productivity and smallholders income. Application of beneficial microbes (Biofertilizers) was found beneficial in terms of higher nutrients use efficiencies, yield, growers income, soil health and sustainability.

Key words: *management, field crops, climate change.*

AN ANALYSIS OF ECOLOGICAL FOOTPRINT IN RURAL URBAN AREAS OF DISTRICT SWAT, KHYBER PAKHTUNKHWA (PAKISTAN)

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Abstract

Ecological footprint (EF) is the measure of humans demand on nature i.e. how much productive land area is required for producing the products and resources consumed and the waste generated by humans. The ecological footprint accounts six components namely crop land, carbon land, grazing land, forest land, fishing grounds and built-up land. These demand and supply components are added together to get aggregate ecological footprint. The problem of ecological overshooting is being faced by many developing countries such as Pakistan where sustainable practices are indispensable. According to the Global Footprint Network, Pakistan is among the list of the countries which are ecologically in deficit i.e we are consuming more than we have the available biocapacity with us. The ecological footprint of Pakistan in 2012 was 0.8 Gha per capita and biocapacity 0.4 Gha per capita. This is high time to think that whether we are living within our ecological limits and how fast humans are depleting the earth's biosphere. With this background, the present study aims to estimate the ecological footprints at household level taking into account the food, housing, transportation, consumer goods and services in district Swat. Besides, the drivers of the ecological footprint and their impact on the ecological footprint have been also estimated. This study used primary data which was collected through questionnaire adopted from the questionnaire designed by Stockholm Environment Institute (SEI). To support the analysis, additional information were also collected which were not available in the questionnaire of SEI. The information obtained were converted into EF though calculator of SEI. The analysis coveredboth rural and urban areas of district Swat. The study used a sample of 1063 households from 7 tehsils of district Swat. The sample size was proportionally allocated to rural and urban areas of the each tehsil. Accordingly, 743 and 320 households were selected from rural and urban areas, respectively. To ensure more variation in the sample, only one respondent from each household was selected. The respondents were selected on the basis of simple random sampling method. The descriptive statistics were used to compute and analyze the total and components of the EF while regression analysis was also used to estimate the determinants of EF such as household income, family size, housing characteristics, energy and food use, ownership of vehicles and animals, education and source of heating and waste.

Key words: *ecological footprint, rural-urban areas, Pakistan.*

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IMPACT OF UNTREATED SLAUGHTERHOUSE EFFLUENT ON THE ACCUMULATION AND UPTAKE OF ZN, NI, AND CD BY RICE (*ORYZA SATIVA* L.) CROP

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Abstract

Rice is the most important staple food in Asia and it constitutes about 35 to 80 % of calories. Untreated slaughterhouse effluent can be used as a source of irrigation to crop. This wastewater contains organic matter which enhances soil fertility. Soil fertility and nutrient management is the main limiting factor in the agriculture sector in many developing countries that have a direct impact on crop yield and quality. Enhancement of fertility status of the soil is significant to increase the productivity of Agricultural soil. A pot experiment was conducted to monitor the impact of untreated slaughterhouse effluent (SHE) on the accumulation and uptake of Zn, Cd, and Ni by rice crop. The experiment was conducted in the wire house of Institute of Soil and Environmental Sciences, University of Agriculture, Faisalabad during the summer season 2020. Twenty days old nursery of rice seedlings variety Basmati-385 was transplanted in glazed pots having 10 kg normal soil. Each pot consisted of three rice plants. Treatments included (control), untreated slaughterhouse effluent (SHE), 50% dilution SHE with tap water (1:1), alternate (SHE/Tap water) irrigation. Recommended doses of N, P, and K nutrients were applied in each pot. The experiment consisted of three replications arranged in a completely randomized design (CRD). At maturity, crop was harvested and growth parameters were recorded. Result indicated that maximum plant growth was observed with 50% diluted slaughterhouse effluent, while significant impact of 50% SHE dilution was also observed in decreasing the Zn, Ni and Cd concentration of rice shoot and grains.

Key words: *slaughterhouse, crop.*

POTENTIAL ANTIMICROBIAL COMPOUNDS IN FLOWER EXTRACT OF *PLUMERIA ALBA*

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Abstract

The present study was carried out to investigate the antimicrobial activity of methanolic flower extract of *Plumeria alba* and identification of the possible antimicrobial compounds through GC-MS analysis. Antimicrobial efficacy of methanolic extract of 5 ppm to 1000 pmm concentrations was assessed against five fungal (*Trichoderma viride, T. harzianum, T. hamatum, T. reesei* and *T. koningii*) and five bacterial species (*Escherichia coli, Salmonella* sp., *Pseudomonas* sp., *Bacillus* sp. and *Staphylococcus* sp.). In general, all the concentrations of the extract significantly reduced growth of all the fungal and bacterial species. However, there was a significant variation in susceptibility of different fungal and bacterial species to the applied concentrations of the extract. The extract was most effective against *T. reesii* followed by *T. viride, T. harzianum, T. hamatum* and *T. koningii* causing 11–97%, 36–90%, 24–86%, 7–77% and 9–76% reduction in their growth, respectively. Similarly, there was 23–93%, 12–92%, 36–90%, 19–90% and 8–84% reduction in growth of *Bacillus* sp., *Staphylococcus* sp., *E. coli*, *Pseudomonas* sp., and *Salmonella* sp., respectively. GC-MS analysis of the extract showed the presence of 24 constituents. The most abundant compound was benzofuran, 2,3-dihydro- (26.64%). Other important compounds included cyclononanone (13.91%), 9-octadecyne (13.62%), 9,12,15-octadecatrienoic acid, methyl ester, (Z,Z,Z)- (9.80%), benzyl alcohol (5.31%), 1-decanol, 2-hexyl- (5.19%), 2,6-octadien-1-ol, 3,7-dimethyl-, acetate, (Z)- (3.59%), 4H-pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl- (2.37%) and heptadecane (2.32%).

Key words: *flower extracts, antimicrobial activity.*

NUTRIENT USE EFFICIENCY OF CHILIES PLANTS CULTIVATED WITH ACIDIFIED IRRIGATION WATER

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Abstract

The use of sulfuric acid as soil amendment for the reclamation of calcareous sodic soils is thoroughly investigated in literature. However, little information is available on the effect of rate and frequency of sulfuric acid drenching in irrigation water on growth and yield of vegetable crop plants cultivated in non-sodic calcareous soils. A pot experiment was conducted using chili as test plant with six levels of sulfuric acid viz. 0, 5, 10, 20, 40, 80 ppm applied once, twice or thrice with irrigation water. Various growth and yield parameters were observed during growth period or at final harvest. It was noted that sulfuric acid application significantly affected almost all growth and yield parameters of chili plant. The acid drenching with irrigation water significantly reduced soil pH even at 5 ppm (equivalent to 10 kg ha^{-1}) concentration maintained in irrigation water. Parameters like fruit number, fruit weight, biological weight, rate of soil respiration, extractable soil phosphorous and soil EC were gradually increased with increasing rate frequency of H_2SO_4 drenching in irrigation water.These results need to be confirmed in field experiments by considering economics of the practice and long term effects on soil nutrient status in various cropping systems.

Keywords: *calcareous sodic soils, chili, sulphuricacid.*

PROTECTIVE POTENTIAL OF PLANTS OF DEOSAI PLAINS AFTER 1ST WAVE OF COVID-19

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Abstract

Covid-19 being global pandemic requires special attention of health professionals. In this context, conventional medicinal plants have been considered as more potent and cost effective agents providing an unlimited source of chemical diversity to treat many ailments. Hence, the present study was conducted to find the protective sources from the unique habitat of Deosai plains. A total of 20 plants belonging to 16 families were found to treat Covid-19 and acted as immunity booster after recovery. The study area included Deosai Plains, declared as Deosai National Park, situated at an average elevation of 4,114 metres (13,497 ft) above sea level and considered as the second highest plateaus in the world of an area of 843 square kilometres (325 sq mi). It is well known for its rich flora and fauna of the Karakoram-West Tibetan Plateau alpine steppe eco-region. Ethnobotanical survey was conducted during September-October 2020 via semi-structured questionnaire from local informants. This study provides a sound foundation for the basic utilization of medicinal plants asimmunity boosters against pandemic of Covid-19 for their inexpensiveness, easy availability and self-administration. Further research and clinical trials are required for the efficient utilization of these plants.

Keywords: *Covid-19, medicinal plants, Deosai plains, immunity booster.*

A MELIORATIVE EFFECTS AND SOIL CARBON SEQUESTRATION POTENTIAL OF ORGANIC AND IN-ORGANIC AMENDMENTS IN SALT-AFFECTED SOILS IN A SEMI-ARID REGION OF ASIA

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Abstract

Application of gypsum (G), organic amendments and their combinations used in this study proved effective in reclamation and increasing carbon stocks of marginally salt-affected areas (Dijkot, Uchkera and Jhang). Gypsum along with farmyard manure (FYM), poultry manure (PM) and green manure (GM) were used in this study. Except of the control, treatment 1 received 100% soil gypsum requirement (SGR), all other 3 treatments received 50% SGR and equal amounts of FYM, PM and GM, respectively. A 45 day's incubation study comprising four intervals (0, 15, 30, 45 days) resulted in the fact that 45 days were more effective than 0, 15 and 30 days of the incubation period. All the amendments effectively reclaimed the salt-affected soils and increased soil carbon stocks by increasing carbon sequestration rate by reducing soil pH (up to 19% in S-1 and S-3), electrical conductivity (EC) (up to 28% in S-3) and sodium adsorption ratio (SAR) (up to 71.55% in S-3),while cation exchange capacity (CEC) (up to 39% in S-1), soil organic matter (SOM) (up to 65% in S-2), and total nitrogen (TN) (up to 96% in S-3) were increased. SOM increase and carbon sequestration were best seen (62%- or 12.59-tons ha^{-1}) in 50% G and FYM application as compared to control (4.45-ton ha^{-1}) in S-1. Results obtained helps in concluding that G and its combinations with organic amendments can effectively reduce the salt concentration in salt-affected soils and helps in organic matter build-up to support crop production and carbon sequestration.

Keywords: *Salts, high temperature, water scarcity, climate change, soil reclamation.*

THE INFLUENCE OF RAILWAY JUNCTION ZDUŃSKA WOLA – KARSZNICE (CENTRAL POLAND) ON THE CONTENT OF TRACE METALS IN SURFACE LEVELS OF SOILS

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Abstract

Railway operations are responsible for the emission of pollutants that adversely affect both the atmospheric air, groundwater and soil. The aim of this study was to assess heavy metal contamination of the top soil level of railway areas. The studies were conducted in the area of railway junction Zduńska Wola – Karsznice (Łódź Voivodeship) and in the village of Florentyna (Greater Poland Voivodeship), where the narrow-gauge railway line runs. In Zduńska Wola soil samples were collected from the inter-railway, 5 m from the main track, from the embankment – 10 m from the main track, from the side track, at the depth of 0-5 cm and 20 cm. In Florentyna, samples were collected similarly. However, soil material was additionally collected from the embankment – 1.2 m from the tracks and from 2 m towards the road on the western side. The soil samples were analysed according to laboratory methods generally accepted in soil science. Heavy metals were determined in the fractions: 0.5 – 0.25 mm, 0.25 – 0.01 mm, and <0.01 mm. In soil samples after mineralisation, trace metal content was determined: Pb, Cd, Cr, Co, Cu, Mn, Ni, Zn, Sr by ICP-MS/TOF OPTIMass 9500. Statistical analysis of the data was conducted using *STATISTICA* software, with the non-parametric Mann Whitney U test. Significant differentiation in soil properties of the areas in Zduńska Wola and Florentyna was found. The analyses carried out showed, among others, accumulation of heavy metals in the topsoil layer, suggesting that the source of these pollutants is mainly railway transport.

Keywords: *Trace metals, Soil, Railway area.*

MANURE APPLICATION AS A SOURCE OF MICROBIAL AND CHEMICAL POLLUTANTS IN THE ENVIRONMENT

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Abstract

The aim of study was the evaluation of the impact of poultry and bovine manure application of soil on the microbial and chemical pollution of soil, groundwater and plants grown on manure-amended soil. Antibiotic and heavy metals (HMs) concentrations were analyzed using the HPLC-MS/MS and HGAAS/ICP-OES methods, respectively, while antibiotic resistance genes (ARGs) were quantified using Real-Time PCR (qPCR) method. Among the tested antibiotics, the highest concentrations were found for ciprofloxacin (CIP) and sulfamethoxazole (SMX) and they were 0-24.8 ng g_{dm}^{-1} and 0-96.6 ng g_{dm}^{-1} ($g_{dry\ matter}$), respectively. Zn and Cu were found in the highest concentration (10^4-10^5 and 10^3-10^5 ng gdm^{-1}, respectively) from HMs tested in all analyzed samples. Among all the analyzed genes, *sul*1 (up to $6.9x10^{10}$ copies per mL org_{dm}), *sul*2 (up to $2.5x10^{12}$ copies per mL org_{dm}) and bla_{TEM} (up to $7.1x10^8$copies per mL org_{dm}) were the most common. Results of the study demonstrate the selective character of ARGs transfer from poultry and bovine manure to plants. The only gene to occur in all studied environmental compartments was *sul*1 (from 10^2copies mL^{-1}in groundwater to 10^{11}copies g_{dm}^{-1} in poultry manure). It was also found that animal manure may cause an increase in the HMs concentration in soil and groundwater and then their accumulation in plants, which may influence the health of humans and animals consuming crops grown on manure-amended soil.

Keywords: *manure, soil, plants, antibiotic resistance genes, antibiotics, heavy metals.*

CHANGES IN THE *EUSTIGMATOS MAGNUS* FATTY ACID PROFILE SUITABLE FOR BIODIESEL PRODUCTION

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Abstract

The aim of the study was to analyze the effect of light intensity and continuous light vs. photoperiod on the growth, lipid content, and fatty acid profile of unicellular algae *Eustigmatos magnus*. The experiments were performed in 500 mL Erlenmeyer flasks with 200 mL of medium with aeration with sterile air and orbital shaking in a phytotron chamber. The growth temperature was 22±1°C. The experimental variants included cultivation of *E. magnus* at a 16/18-h light and dark cycle and continuous illumination under 400 μmol m^{-2} s^{-1}, 60 μmol m^{-2} s^{-1}, and 30 m^{-2} s^{-1} light intensity. The microalgal cells were grown in the batch culture for 11 days. *Eustigmatos magnus* growth was measured by estimation of changes in the optical density with UV/vis spectrophotometry. Based on the measurement of the optical density, the specific growth rate and biomass doubling time were determined. Biomass productivity was determined by measurement of dry weight. The lipid content in *E. magnus* biomass was determined with a modified version of the Bligh and Dyer method, and the fatty acid composition was determined by gas chromatography. The results show the highest specific growth rate of *E. magnus* at the highest light intensity under continuous illumination. The content of fatty acids varied depending on the light conditions. *E. magnus* lipids exhibited high content of palmitoleic acid. The content of monounsaturated fatty acids increased with the growing light intensity in the continuous illumination. The fatty acid profile in *E. magnus* cells cultured under high light intensity meets the biodiesel quality standards.

Key words: *Eustigmatos magnus, fatty acids, biodiesel, palmitoleic acid.*

Acknowledgments: This research was funded by the National Science Centre, Poland, grant number 2016/23/D/NZ9/02670 [2017–2020] to I.K.

IDENTIFICATION OF BACTERIA AFFECTING WHITE MULBERRY (MORUS ALBA) IN POLAND

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Abstract

The white mulberry (Morus alba L.) is particularly valued because its leaves serve as fodder for larvae of the mulberry silkworm (Bombyx mori L.) in the production of raw silk (sericulture). However, the health of silkworm caterpillars producing silk fibres, and the quality of their cocoons depend strongly on fodder quality. Moreover, this plant is also valuable in the food and pharmaceutical industries, where high-quality herbal material is required. In one mulberry plantations trees with chlorotic, angular leaf spots and blotches were observed. The disease multiplied in spring in humid conditions and spread to developing blossoms and leaves. Leaves were collected during two growing seasons. Leaf lesions exhibited bacterial streaming, and bacterial colonies were readily isolated on tryptic soy agar. Biochemical and molecular were carried out. Several bacterial species were isolated. To our knowledge this is the first description and characterization of P. syringae affecting mulberry trees not only in Poland but throughout Europe. This finding serves as a warning for the phytosanitary services in Europe and for the sericulture industry that a new disease threat has appeared for European mulberry crops.

Keywords: *Morus alba L., bacteria, microbiology, agropests, molecular test.*

THE OCCURRENCE AND DIVERSITY OF BETA-LACTAMASE GENES DURING WASTEWATER TREATMENT

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Abstract

Aquatic ecosystems provide an ideal environment for acquiring and spreading of antibiotic resistance genes (ARGs) due to the continuous pollution of these ecosystems with antimicrobial compounds of anthropogenic origin. Therefore, the aim of the study was to investigate the diversity of microorganisms and beta-lactam antibiotic resistance genes, with particular emphasis on carbapenemase genes. The study was carried out at two wastewater treatment plants (WWTPs) with different levels of hospital wastewater in flow by the use of high throughput sequencing. Samples of wastewater and sewage sludge were collected three times from different stages of treatment in both WWTPs. The obtained results suggest that bacteria of the *Fusobacteriaceae* family may be involved in the spread of antibiotic resistance in the environment. Wastewater samples from two wastewater treatment plants receiving different levels of hospital wastewater were compared and a greater diversity of beta-lactam resistance gene types was found in wastewater containing a higher percentage of hospital wastewater (58 types) compared with wastewater containing a lower percentage (52 types). In samples from both wastewater treatment plants, the dominant beta-lactamase genes included bla_{OXA}, bla_{GES},bla_{BEL}, bla_{CfxA} and bla_{TEM}. It is worth noting that the bla_{KPC} and bla_{NDM} genes were only found in untreated municipal wastewater with higher hospital wastewater content. Moreover, an increase in the abundance of the bla_{IMP} gene after the biological treatment stage in the studied treatment plants was found. Considering the above, the current research indicates that the inflow of hospital wastewater contributes to the spread of antibiotic resistance in the aquatic environment.

Keywords: *antibiotic resistance genes, wastewater treatment plants, bacteria, beta-lactamase, carbapenamase.*

Acknowledgments: This research was funded by grant No. 2017/26/M/NZ9/00071 from the National Science Centre, Poland.

ANALYZES OF THE ENVIRONMENTAL BIOFILM

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Abstract

As it is known, bacteria can grow as planktonic (so-called free-living) cells or as a multicellular prokaryotic organism, referred to as a biofilm. This structure is very complex and can be called a multicellular organism. It is very sophisticated and bacteria that create it can switch their metabolism and additional gene expression can be observed. Furthermore, the bacteria can produce extracellular polymeric substances (EPS), that protects them from extreme environmental conditions, like UV radiation, low pH or high salinity. Thus, environmental biofilm is an extraordinary structure that needs to be investigated as complex. In our studies, we investigated the biofilm samples collected from the closed mine in Radzimowice mountains, Poland. The polymetallic Radzimowice deposit characterizes by stable temperature (7 °C), extremely low pH (1-1.5), high redox potential (250-350 mV), and significant concentration of heavy metals, ranging from 0.019 mg/L to 166 mg/L for cadmium and iron respectively. Thus, can be classified as acid mine drainage (AMD). We were able to image the structure by the cryo-SEM and analyze the geological background of the area. Furthermore, we used a metagenomic approach to analyze the microorganisms that were creating it. The results show not only the complex structure but also a big number of the bacteria that can create it, including 34 bacterial species. In our opinion, all environmental biofilms have to be treated as multicellular prokaryotic organisms connected and investigated with their environment.

Keywords: *bacteria, biofilm, metagenomic, environment.*

APPLICABILITY OF BACTERIAL NANOCELLULOSE

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Abstract

Fossil-based materials are used in various areas, such as packaging, electronics and commercial field, own their positive properties (high transparency; chemical stability; flexibility or stiffness; adequate gas, aroma and flavor barrier; impact performance; excellent mechanical and optical characteristics; easy to process; cheap), the best part of them being used in the food packaging sector. These materials are extremely useful in ensuring food safety, color, aroma, flavor and freshness retention, and in extending the shelf life of food products. Despite the fact that polymer packaging materials have many advantages, they have an enormous negative impact on the environment. The most fossil-based plastics end up in landfills and ocean, causing damage of the ecosystem. Their mechanical recycle is not the most economically-favourable choice, moreover much of the polymer materials can only be recycled once or twice. The incineration has a serious environmental influence through carbon dioxide (a principal driver of climate change). The environmental issues related with the fossil-based materials (post-consumer plastic waste, greenhouse gas emissions, climate change) and safeguarding of natural resources determine the movement from these materials to greener biodegradable polymers from natural resources. Bacterial nanocellulose (also known as microbial cellulose) has the potential to reduce the environmental pollution associated with the fossil-based polymers, due to combination of remarkable properties such as renewability, biodegradability, green processing, and good mechanical performance, high chemical purity, flexibility, non-toxicity, low production costs. In this paper, the recent studies on the applicability of bacterial nanocellulose in the antimicrobial food packaging have been summarized and discussed.

Keywords: *Bacterial nanocellulose, Greener polymer, Food packaging.*

DETERMINATION OF ORGANOCHLORINE PESTICIDES IN SURFACE WATER FROM TIMIȘ AND SIBIU COUNTIES IN ROMANIA

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Abstract

Organochlorine pesticides (OCPs) are continually detected in the environment due to their increasing applications in agriculture and industry. The presence of OCPs in the environment is not desirable since they are well known to have negative impact in humans, animals and birds. Thus, there has been a continual demand to monitor the presence of OCPs within the environment. Surface waters play an important role in long range transport of pesticides. Organochlorine pesticides are most often found in the water sources due to their increased persistence in the external environment. In this study were determined some organochlorine pesticides in Târnava Mare River from Sibiu County and Bega River from Timiș County. For the analysis of OCPs was used gas chromatographic method with electron capture detection (GC-ECD) for separation and quantification. The results obtained were below the maximum concentration admitted by Law 458/2002 republished in 2017 (national law, 2017) regarding drinking water quality and according with the requirements of the Drinking Water Directive (Council Directive 98/83/EC/1998) intended for human consumption. The solution to reduce risk of pesticides use is ecological agriculture, which gains increasingly more ground in Romania too.

Keywords: *organochlorine pesticides, surface waters, agriculture, ecological.*

EUROPEAN LAND ABANDONMENT AND HOW A MORE DETAILED FOREST DEFINITION CAN HELP

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Abstract

Land abandonment has been a recurring issue in Europe since the second half of the 20th century. Due to the rise of labour costs, fierce international competition, and rural emigration (to name only a few factors), estimates show that 19,6 million hectares of agricultural land have a high chance of being abandoned until 2030, in Europe alone. Currently, there is a general lack of legal definitions of marginal lands and its vegetation in European policies, hindering the ability to deal with consequences of this trend efficiently. The outcomes of this unmanaged vegetation, growing wildly in former agricultural lands, vary from loss of biodiversity (when compared to traditional grasslands) to the increased risk of wildfires (due to the highavailability biomass). This paper proposes that a better legal definition of marginal lands, alongside with a more detailed forestry policy, with a wider array offorest definition will aid and foment sustainable management of the "new" forests in former agricultural land.

Keywords: *Marginal lands, Land abandonment, New forests.*

EVEN THOUGH THERE IS SUCH BENEFIT, THERE AREHUMAN-MADE DISRUPTIVE CHANGES

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Abstract

Soil is an important component of forest and wood land ecosystems as it helps regulate important ecosystem processes, such as nutrient uptake, decomposition, and water availability. Soils provide trees with anchorage, water and nutrients. Soil is used as a basic component of forest ecosystems. It is made up of a variety of minerals, organic matter, and living organisms. Soils are also crucial for global food security, water security, biofuel security, and human health, in general sustaining ecosystem. Forest ecosystemof soil is a key component of the Earth system to control geochemical, biological, erosional, and hydrological cycles, as well as providing utilities, products, and energy to humans.

Keywords: *Soil, Forest ecosystems, Basic components.*

AGRICULTURAL DROUGHTS AS EXTREMELY LONG PERIODS WITHOUT RAINFALL IN VOJVODINA PROVINCE, SERBIA

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Abstract

Long periods without rainfall during the growing season April-September are extremely important from the perspective of agricultural production. Considered as agricultural droughts, so-called rainless periods can be defined in different ways and modelled as stochastic process of extremes accordingly. Already verified as a good modelling strategy with valuable results, the ZT approach (named after Zelenhasic and Todorovic) is used in different earlier studies to identify probability distributions of selected component of this complicated stochastic process across territory of Vojvodina Province, Serbia. In its essence, the rainfall process is punctual from the measuring/observing point of view. That is, it is recorded at meteorological or rainfall stations which are spatially distributed, commonly differently exposed to continuous or sudden storm rainfall. In other words, if there is rainfall at given location, it may happen that at a 10 km distant measuring point there is no rainfall at all. Spatial and temporal analysis of rainfall events in long periods such as historical period of 50 years (1961-2010) is obviously comprehensive task. During the transnational project 'DriDanube‑ Drought Risk in the Danube Region' the authors of this article analysed complete stochastic of the rainless process across 10 partner countries in the midland lower part of the Danube basin. Principal data sources have been climatic data bases for the Danube region (CarpatClim and DaubeClim) and 50 years long records of daily rainfall at 162 locations, including 20 selected locations in Serbia. Major results of this analysis are presented in references . In this paper we present selected results obtained for Vojvodina Province: empirical and theoretical (by ZT method) distributions of the number, duration and extreme duration of rainless (drought) events. Based on expert suggestions by agronomists, droughts (rainless periods) are defined as periods of 20 and more consecutive days during the growing season with rainfall less than 3 mm per day, all in multiyear period. Droughts are identified as mutually independent stochastic events and then used to compute empirical and theoretical (by ZT method) distributions of number of droughts, drought durations and durations of longest droughts. Representative maps of droughts produced in GIS environment and the recommendations how to use them, are given in the article.

Key words*:* *agricultural droughts, stochastic process of extreme droughts, ZT method.*

COMPARISON OF CELL WALL STRUCTURE OF DIFFERENT WESTERN BALKAN PLANT SPECIES AS A SOURCE FOR BIOFUELS

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Abstract

Understanding of composition and connections between the building macromolecules of plant biomass, such as cellulose, hemicellulose and lignin, is main key for their better utilization in biofuels industry. We compared four different plant species which are abundant in the region of the Western Balkans. We investigated the structure of the cell walls, as the main constituent of plant biomass, isolated from branches of softwood (*Picea omorika* (Pancic) Purkine), hardwood (*Acer platanoides L.*), maize stem (*Zea mays L.*) as examples of crop species, and *Paulownia tomentosa* tree as a fast-growing species with a huge biomass yield. For our investigation, we combined Fluorescence-detected linear dichroism (FDLD) method and X-ray Diffraction. We obtained data for anisotropy and crystallography which are a base for prediction of the best and appropriate plant species for easy deconstruction of its biomass. Our results show that Acer branch as a hardwood shows the highest anisotropy and the lowest crystallinity compared to the other species while *Picea Omorika* needles show opposite results as the lowest anisotropy and the higher crystallinity. The results for maize show that the stems are easier for utilization than leaves. The isolated cell walls from leaves of *Paulownia tomentosa* show similar results and good correlation between anisotropy and crystallinity, thus we can conclude that this plant is easy to use in biofuel industries.

Keywords: *cell wall, biofuels, anisotropy, crystallinity.*

THE INFLUENCE OF ALKALINE HYDROLYSIS CONDITIONS ON THE ISOLATION OF HEPARIN FROM THE PORCINE INTESTINAL MUCOSA

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Abstract

The slaughter industry produces large quantities of animal tissues and organs as by-products. Most of them are nonedible and represent the waste which disposal could lead to the environmental problems. For instance, the unused porcine intestinal mucosa is a wastewater pollutant. On the other hand, it is a significant source of heparin, a polysaccharide of glycosaminoglycans that is used as an anticoagulant to prevent blood clotting. The animal tissues and organs are still the only sources for its commercial production. In this work, the isolation of heparin that included the extraction from the fatty mucosal cells by alkaline hydrolysis and sorption on ion exchange resins was studied. The alkaline hydrolysis was performed by an aqueous solution of ammonium chloride at pH=9 (adjusted by ammonium hydroxide) and temperature at 78°C until boiling and then boiled for 10 min. The aim of this work was to determine the influence of ammonium chloride concentration on the yield and activity of heparin. Therefore, the various concentrations of ammonium chloride (0.54 mol/l, 0.74 mol/L, 1.0 mol/L, 1.56 mol/L) at constant liquid-to-solid ratio of 1:0.5 were investigated. The heparin anticoagulant activity was analyzed in a crude and purified extract using the standard biological method (European Pharmacopeia). The considerable influence of ammonium chloride concentration on the heparin yield and activity was observed. The obtained results showed that thehighest yield and activity of heparin were achieved by using a lower concentration of ammonium chloride (0.54 mol/L and 0.74 mol/L).

Keywords: *Ammonium chloride, Extraction, Heparin, Intestinal mucosa, Isolation.*

GEOGRAPHICAL ORIGIN OF ALIEN INVASIVE FISH SPECIES IN SERBIA

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Abstract

Aquatic ecosystems around the world have been dramatically altered as fish are shifted around, whether for commercial fishing stock or the aquarium trade. Hydroecological conditions in Serbia have caused a high diversity of its ichthyofauna including about 94 permanent or occasional fish species recorded in Serbian watercourses. However, among them are numerous non-native fish species, which often show an invasive character. According to one of the lists of invasive species in Serbia, 29 species of fish are marked as invasive. In order to prevent further introductions of potentially invasive alien fish species, it is of great importance to know the ecology, but also the biogeography of those species that are currently considered invasive in Serbia. In general, among invasive fish species in Serbia, those originating from the Old World are more common than those coming from the New World. Palearctic origin has 14 invasive fish species, of which 8 have a primary geographic range limited to Europe, while 6 of them are known to have a primary geographic range in both Europe and Asia. There are 6 species of Nearctic origin, 5 species of Sino-Tibetan origin and 1 species of Neotropical origin, while the primary range of some species occupies more than one biogeographical region. However, in contrast to these species with very large primary geographic ranges, some of the species that have been marked as invasive in Serbia are even endemic to the Balkan or Apennine Peninsula, while some are classified as vulnerable according to the IUCN categorization.

Keywords: *Geographical origin, Invasive fish species, Serbia*.

THE VALORIZATION OF EDIBLE INDUSTRIAL WASTE IN FOOD PRODUCTION

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Abstract

Food processing wastes have long been considered as a matter of treatment, minimization, and prevention due to the environmental effects induced by their disposal. Nowadays, food wastes are accounted as a source of valuable nutraceuticals and deal with the prospects of feeding fast growing population in 21st century. The large amount of waste produced by the food industry, in addition to being a great loss of valuable materials, also raises serious management problems, both from the economic and environmental point of view. Many of these by-products are usable as raw materials for other purposes. Waste valorization is an attractive approach of increasing popularity which can offer a range of potentially useful alternatives for dealing with residues other than disposal and/or landfilling. Using by-products of the food industry generated the conditions that certain synthetic ingredients, that can be a source of toxicity, can be replaced with natural components. Today, food wastes are considered as a cheap source of valuable components since the existent technologies allow the recovery of target compounds and their recycling inside food chain as functional additives in different products. One such product is the residue after distillation of essential oil from the wild oregano which can be exploited by the preparation of food products with functional properties due to the fact that the wild oregano is one of the strongest natural antioxidants. Addition of functional component to the raw material composition of the corn flakes shows the double increases of phenol content, with a maximum phenol content of 2.84 mg GAE / g s.e. in the sample with 1% dry residue of wild oregano. This sample is also characterized by the maximum antiradical activity of the extracts expressed over parameters 1 / IC50 (0.75 mg / ml) and FRAP values (1.57 μg AAE / g s.e). The obtained data indicate that investigated corn flakes with the addition of wild oregano represent a new food product with good physical-textural and sensory properties due to a higher level of antioxidant activity. Moreover, it may contribute to the valorization of edible industrial waste in food production.

Key words: *food waste, food production, new food products.*

CHARACTERIZATION OF FUNGAL ISOLATES FROM DIFFERENT TYPES OF SOIL AND THEIR ABILITY TO DEGRADE CELLULOTIC ORGANIC MATTER

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Abstract

Soil microorganisms have a central role of synthesis and mineralization of organic matter. Isolation, determination and selection of effective fungi isolates, which contribute to better and faster decomposition of organic matter in soil, represent major steps in creating a biofertilizers – microbiological fertilizers. A large amount of cellulose comes into soil every day, through organic remains, and it is decomposed by cellulolytic fungi and bacteria. The aim of this research was to isolate fungal strains with the best degradation potential, by isolating the microorganisms from five different types of soil. Morphological, physiological, biochemical, PGP characterization were also examined. This would enable further research and formulation of microbiological preparation. Based on morphological characterization and determination of fungal isolates, it was determined that the following isolates: LG1, LG2, LG3, ČG6, ŠG5, ŠG10 and ŠG11 belonged to the genus *Penicillium*. The isolates: ČG3, ČG5, ČG21 and ŠG17 belonged to the genus *Aspergillus*. Isolate RCG3 belonged to the genus *Trichoderma*. According to morphological characteristics, the isolate RCG3 was most likely *Trichoderma harzianum*. In our researches the isolates from the genus *Penicillium* sp. (ČG6, ŠG11), and *T. harzianum*, in all three investigated substrates (straw, beech, leguminose), degraded the crude cellulose from 38.38% to 81.69% more during a period of 30 days of incubation period. These selected isolates of fungi showed an increased potential for the degradation of cellulose and organic matter, and they could be used for the formulation of microbiological fertilizers that would be used in agricultural production to accelerate the mineralization process.

Keywords: *Fungi, Cellulose, Organic matter, Biofertilizers.*

ECOLOGICAL AND ECOPHYSIOLOGICAL BASES OF BIOLOGICAL MONITORING

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Abstract

Guidelines for the national list of indicators prescribe ten areas in which the state should be monitored for the purpose of environmental protection. Under these guidelines, natural and biological diversity has been categorized as the third group of indicators. It is represented by four groups of indicators: 3.23. Endangered and protected species; 3.24. Protected areas; 3.25. Species diversity, and 3.26. Forests: dead trees. We dedicated particular attention to the indicators of group 3.23 – Endangered and protected species. A precise list of these species in Serbia has been included in a special guideline. From the list, we chose the fish species *Cobitis elongate* (Heckel&Kner, 1858) (fam. *Cobitidae*), a part of which areal distribution encompasses the middle and upper courses of the Ibar River. For many years, the Ibar River has been known for persistent incidents of pollution with phenol, produced in the TE "Obilić power station", which get to the Ibar through a network of water ways. Guidelines for the national list of indicators in Serbia predict the monitoring of parameters related to the concentrations of biological oxygen demand (BOD) and ammonia (NH4 – N) as measures of the state of surface water. This paper aims to analyze the ecological and ecophysiological effects of phenol on the chosen protected fish species and its potential value as a bioindicator, in addition to the general practice of biomonitoring.

Key words: *protected species, bioindicators, biological monitoring.*

HUMUS CONTENT IN SERBIA TO THE MAPPING INVESTIGATED PITCH

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Abstract

Soil is one of the most important resources of each state. The research in this study was conducted in order to preserve this very important resource. Humic substances have a positive effect of water-air maintenance and total biological properties of the soil which have a direct impact on plant nutrition and and in the first place on the nutrition of plants with nitrogen. Humus content is the basic parameter of soil fertility. The paper analyzes humus content of 21 localities in central Serbia. Total is examined 5.313 samples. Results on humus content indicate that there are soils from insufficiently humus to extremely humus. In 92% of the examined soil samples are weak and medium humus, 7% of the soil is very humus a only 1% insufficiently humus. The obtained results can be related to the natural properties of soil types on the examined plots, but also to the way of applying fertilizers on them. Natural climatic processes and the impact of anthropogenic influence, man continuously affect changes in soil quality. All plots are mapped and based on the obtained results recommendations are given agricultural producers on repair measures and application of organic and mineral fertilizers.

Key words: *Soil, conservation of resources, humus content, repair measures, mapping.*

URBAN GREENERY RESEARCH: LEARNING TRENDS FROM THE PAST DECADE

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Abstract

Cities play an enormous role in societies and daily human lives. Around 68% of the world population is projected to live in urban areas by 2050. Rapid urbanization has separated human beings from nature exposure, and one way of bringing nature back and integrating it into urban infrastructures is the careful planning and management of urban green resources (e.g. urban gardens, parks, woodlands, etc.). The overall goal of this study was to examine urban greenery research focus and trends using bibliometric methods. A search was conducted using Scopus to identify English language papers on urban greenery published in peer-reviewed journals between 2010 and 2020. In order to identify themes focuses, content analysis was conducted to analyze the keywords, specifically the frequency of occurrence of the articles' keywords. Overall, 7045 publications related to urban greenery research were obtained as the data for this study, where more than 60% of all papers published, fall into the category of environmental science. Evaluation of the keywords used in papers published over the last decade shows that the tendencies of the body of literature related to this topic are mostly oriented towards land use planning. Observed publication trends and publication characteristics, as well as disciplinary contributions, are further discussed.

Key words: *urban greenspace, key word, Scopus, article.*

SURVIVAL OF MICROORGANISMS IN CRUDE OIL POLLUTED SOIL

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Abstract

Soil pollution by crude oil can occur naturally via spillage, accidents or improper disposal of crude oil and related products. Indigenous soil microorganisms such as bacteria, yeasts and filamentous fungi can use crude oil hydrocarbons as food and source of energy. They transform the complex organic compounds into less toxic or non toxic substances such as carbon dioxide, water and fatty acids. The aim of this research was to follow the survival of microorganisms in crude oil polluted soil in *in vitro* conditions. Two dosages of crude oil were tested (5 and 20 g kg^{-1}). Total number of bacteria, actinobacteria, fungi, aminoheterotrophs and azotobacter were monitored during six months period. Addition of crude oil negatively affected only the number of actinobacteria and azotobacter and the number decreased in relation to the control at the beginning of the experiment. Six months later, the total number of bacteria did not change significantly (log No 7.83 to log No 8.96 g $soil^{-1}$, respectively), regardless of the amount of added crude oil. Number of fungi decreased (log No 3.79 g $soil^{-1}$) as well as the number of azotobacter (log No 3.88 g $soil^{-1}$). The obtained results suggested that the autochthonous soil microorganisms adapted well and had high survival rate.

Key words: *microorganisms, crude oil, survival, pollution.*

INFLUENCE OF ENVIRONMENTAL FACTORS ON INSECT POLLINATORS IN NORTHERN SERBIA

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Abstract

One of the major consequences of anthropogenic influence is the evident decrease in the diversity and number of insect pollinators. Being highly vulnerable ecosystem service, mainly due to agricultural intensification, the spread of diseases and parasites, and pesticide pollution, loss of pollinator diversity may lead to loss of other species that directly or indirectly rely on them and could have significant economic impacts by reducing crop pollination services. In this study, we examined the relationship between environmental variables (altitude, distance from the nearest agricultural area, grazing intensity, and mowing) on the composition and abundance of pollinator species. Pollinators were sampled on the territory of the Autonomous Province of Vojvodina in the Republic of Serbia, on four types of habitats categorised according to the CORINE land cover classification as classes 2.1.1 Non-irrigated arable land, 2.4.3 Land principally occupied by agriculture, with significant areas of natural vegetation, 3.1.1 Broad-leaved forest and 3.2.1 Natural grassland. Our results showed a significant correlation between the composition of pollinator species and the overall set of environmental factors. We found that forest, followed by grassland habitats, had the most diverse pollinator communities. Localities under grazing and mowing appeared to be less diverse in pollinators, whereby agricultural areas had the lowest pollinator diversity. Our findings suggest that the diversity of pollinators is highly influenced by land use and confirm the importance of forest habitats in agricultural landscapes such as Vojvodina Authonomous Province in Serbia as important refuge habitats for foraging and nesting of pollinators.

Keywords: *pollinator diversity, pollinator abundance, habitat types, land use.*

RASPBERRY PRODUCTION AND ECONOMIC VALUE OF INSECT POLLINATION OF RASPBERRY IN SERBIA

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Abstract

The Republic of Serbia ranks among the largest producers of raspberry on the global market, with an annual production of circa 120,000 tons and an export of 80,000 tons. Although commercial raspberry cultivars are largely self-fertile and self-pollinate autogamously, without insect pollination the fruits are small or crumb. Insects that are mainly used to pollinate commercial raspberries are honeybees. In this research, we analyse the production of raspberries in the Republic of Serbia, for the whole country and separately for the northern and southern region during the period from 2010 to 2020, as well as estimate the economic value of insect pollination (EVIP) ecosystem service of raspberry in the same decade. Likewise, we presented the total value of raspberry crop (TVC) to emphasize the importance of insect pollination to the yield. In Serbia, the annual yield of raspberries ranged from 70,000 tons in 2012 to 127,000 tons in 2018, but over 90% of the yield is produced in the southern region. Considering producer price per metric ton, annual raspberry production and dependence upon the insect, the estimated EVIP ranged from approximately 48 million EUR in 2011 to 117.5 million EUR in 2020. In the observed period, the TVC has been followed the EVIP's trend to conclude, insect pollinators represent a significant share of TVC; they have a substantial positive impact on raspberry production, therefore conservation activities and good management practices are needed to maintain and improve the ecosystem pollination service in relation to this Serbian brand.

Keywords: *pollination service, EVIP, raspberry yield, honeybees*.

STATUS AND SWOT ANALYSIS OF DEER POPULATION MANAGEMENT AT THE HUNTING GROUNDS IN CENTRAL SERBIA

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Abstract

The aim of this study is to perform an analysis of the roe deer population in Central Serbia and a SWOT analysis of the management. Data we used regarding the number of roe deer individuals and culling was taken from the Ministry of Agriculture, Forestry and Water Management - Forest Administration and the Republic Statistical Office. The condition of roe deer populations on the hunting grounds in Serbia is diverse depending on the area and hunting grounds, but overall, quite unsatisfactory. In 2021, 86755 individuals were recorded in the area of Central Serbia, which is 97.54% of the optimal fund. However, if we look at the individual hunting grounds from the Central and Eastern hunting area, the number of roe deer is above the optimal fund, while in the Southern and Western hunting area, the number of roe deer is 88.58% and 89.12% of the optimal fund. Eastern (2.06) and Belgrade (2.02) hunting areas have the highest number of individuals per unit (km^2), while Southern (1.02) and Western (1.34) have the lowest number of individuals per unit (km^2). A number of factors affect the difficulty of the roe deer populations management at the hunting grounds: legislative and regulatory instruments, non-compliance and non-enforcement of a large number of regulations, problems in roe deer monitoring, poor hunting ground control, inapplicability of certain regulations in the field of veterinary medicine, environmental protection, unresolved issue of trophy and game meat export, lack of strategic planning - Hunting development strategies of the Republic of Serbia, lack of deer habitat monitoring methodology and rating methodology, unprofessional planning and development of hunting ground management plans. The SWOT analysis pointed out the strengths, weaknesses, opportunities and threats in managing the roe deer populations in Serbia.

Key words: *Capreolus capreolus L., Management, SWOT analysis.*

HOW ECOSYSTEM SERVICES OF THE FLOODPLANS CAN CONTRUBUTE TO THE BETTER WATER QUALITY IN THE DANUBE REGION: IDES PROJECT

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Abstract

More than 80 million people live in the Danube catchment area, and - just like flora and fauna – they are dependent on a good water quality. The IDES project *Improving water quality in the Danube river and its tributaries by integrative floodplain management based on ecosystem services*, co-funded by the European Union (ERDF, IPA) aims to develop and implement a transnational integrative ecosystem service approach (named as IDES Tool) to improve water quality management and to generate win-win situations for multifunctional flood plains instead of trade-offs. The IDES Tool should enable the national key actors in water quality management to identify sustainable measures respecting, in the same time, needs of the other sectors. The DES Tool is innovative and it will provide, both in pilot areas and on the transnational level, a comprehensive ecosystem service assessment for floodplains andenable sustainable decision making processes in floodplain management. During the two-and-a-half-year implementation timeline, key actions will focus on the following: 1. Analysis of present situation of water quality in the floodplains along the Danube, assessment of ecosystem services and joint development of the framework of ecosystem service evaluation tool (IDES tool). 2. Stakeholder workshops in five pilot areas in Serbia, Austria, Slovenia, Hungary and Romania where the new water quality management concepts will be elaborated and assessed by the IDES Tool. 3. Joint development of a transnational strategy that will provide operational pathway how to integrate the ecosystem service approach in future water quality planning processes. In this paper we present results of the project activities related to Special Nature Reserve Koviljsko-petrovaradinski rit, which is the Serbian Pilot area (KPR). Key aspects are: (1) assessment of land use changes in KPR in the period 1990-2018 and, (2) fuzzy cognitive modelling of ecosystem–pressures–measures relationship in cooperation with stakeholders of KPR.

Key words: *water quality, floodplain, ecosystem services, IDES project.*

ACTIVITY OF SOIL MICROBIAL COMMUNITY AS AN INDICATOR OF PLANT SPECIES INVASION ON SOIL ECOSYSTEM

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Abstract

Invasive alien species pose a significant threat to biodiversity. Non-native plants often have dramatic impacts on the resident vegetation by modifying its composition and structure, decreasing native species abundance and richness via competition, predation, hybridization and indirect effect. The aim of our study was to report that selected invasive plants (*Helianthus tuberosus*, *Heracleum mantegazzianum* and *Fallopia japonica*) altered soil microbial indices and physicochemical properties. The research was carried out during a vegetation season (summer 2017) on Lekárovce and Opátka localities of South-Eastern Slovakia from the depth of 0.15 – 0.20 m. Soil reaction, soil moisture, soil organic carbon, soil basal respiration and soil enzyme activities (urease, FDA, beta-glucosidase, acid and alkaline phosphatases) were determined. Our study showed changes in soil samples with the observed invasive plants compared to the control sites. The results suggest that studied non-native plants have ability to change content of soil moisture. Soil reaction was also affected by invasion, while soil organic carbon was not significantly changed. Determining the intensity of soil respiration is of great importance for assessing the biological activity and the rate of mineralization processes in soil ecosystems. Our findings show reduced soil basal respiration in the presence of invasive plants, especially in *F. japonica* vegetation. The results of soil enzyme activity showed significant changes between invaded and control sites. Based on the results we assume that biology of the invasive plants had the high impact on soil systems and microbial indices might be considered as an indicator of environment disturbances.

Keywords: *Microbial indices*, *Invasive plants*, *Physicochemical properties.*

MERCURY POLLUTION IN FORMER MINING AREA (SLOVAKIA) AND THEIR INFLUENCE ON BIOLOGICAL AND CHEMICAL SOIL PROPERTIES

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Abstract

Current and former mining activities in Slovakia and related industrial activities focused on ore processing have significantly affected the quality of the environment. Pollution of such sites affects all components of the environment, the health of living organisms, including humans. The research was carried out in Nižná Slaná former mining area during the summer of 2019. The soil samples were taken from the vicinity of mining bodies – tailing pond and abandoned area of the ore processing plant. The aim of the study was to determine the level mercury pollution in the surrounding of mining bodies in the Nižná Slaná former mining area, and to evaluate the influence of pollution to the selected biological and chemical soil properties. The total content of mercury was determined by a direct mercury analyzer (AMA-254). Nutrients (Ca, Mg, K and Na), the activity of soil enzymes (urease, acid, and alkaline phosphatase, FDA, and *β*-glucosidase), and soil pH was determined in laboratory conditions. Mercury pollution in the evaluated area was expressed by contamination factor (C_f). Limit value of mercury in soil samples exceeded the permissible limit value at all sampling sites. Contamination factor reached extremely high values, expressing very high contamination at all sampling sites. Higher values of mercury in soil ecosystem have an inhibitory effect to the soil enzymes, but nutrient seems to be resistant. The soil reaction was higher (alkaline), which is probably due to the presence of sludge from the sludge in the soil environment.

Keywords: *Tailing pond, activity of soil enzymes, nutrients, contamination factor*.

ENVIRONMENTAL MANAGEMENT OF LIVESTOCK IN BOSNIA AND HERZEGOVINA ON THE EXAMPLE OF ENVIRONMENTAL PERMITS

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Abstract

Bosnia and Herzegovina has large areas of unused agricultural land that are very suitable for the development of livestock, which has recently become increasingly important in sustainable food production. Environmental management of livestock is imposed as one of the main challenges in politics of environmental protection. Entity legislation, in the field of environmental protection is a framework for environmental management in Bosnia and Herzegovina. Environmental management for large farms is a mandatory part of the environmental permit. The environmental permit is one of the main instruments of environmental policy at the local level in Bosnia and Herzegovina for agricultural business and food producers of eggs, meat, milk and other livestock products. The paper analyses the arguments for obtaining environmental permits for poultry farms in the municipality of Srbac. The research method is based on desk analysis. The subject of the analysis is 30 arguments obtained from local environmental permits, collected by authorised professional companies in the field of environmental protection from the entity of the Republic of Srpska. The collecting period of arguments was from 2011 to 2021 years. Desk analysis allowed identifying the main pollutions on poultry farms production from all elements of the environment and proposed the measures to reduce these contaminants respecting the regulations to national legislation. Finally, discussion and conclusion state the importance of the principles of circular economy in environmental management of livestock for transition to sustainable business of food production.

Keywords: *Bosnia and Herzegovina, sustainable food production, environmental management of livestock, environmental permits for poultry farms, circular economy.*

TRENDS IN EVAPOTRANSPIRATION IN THE SOUTHWEST OF THE IBERIAN PENINSULA, IN THE CONTEXT OF GLOBAL WARMING

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Abstract

The Southwest of the Iberian Peninsula (IP), due to its geographical position, is an area highly affected by climate change. Numerous studies have highlighted the increase in annual temperatures as well as a decrease in rainfall. Both variables considerably affect the performance of crops and livestock, being the primary sector very important for the economy of the area. This study analyzes the evolution (1960-2018) of annual and seasonal Evapotranspiration (ETP, water needs of crops) of the Southwest of IP. Daily data from eight selected weather stations belonging to the European Climate Assessment & Dataset were used. In addition, the evolution of the FAO index (P/ETP) determining what part of the evapotranspiration is covered by precipitation (P) was analyzed. To determine the monotonic trend, the Mann-Kendal test and Sen's slope estimator were used. The results show a significant positive trend of the annual ETP throughout the study area. This trend was found in all seasons except fall and especially spring and summer. The FAO Index showed a smoother general reduction, but with differences between the seasons. Summer was the most affected season by this reduction. All this indicates that the water needs of the crops are increasing, and that the contribution of rain is decreasing, especially in the most demanding seasons (spring and summer), so that irrigation resources will increase progressively. It is necessary to introduce species more tolerant to drought, the application of deficit irrigation strategies and the implementation of new and more efficient irrigation technologies.

Keywords: *Evapotranspiration, seasons, precipitation, temperature, climate change.*

CHARACTERIZATION OF PHOTOSYNTHETIC ACTIVE RADIATION IN BURGOS

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Abstract

Photosynthetically Active Radiation (PAR) is the fraction of the solar radiation spectrum that produces biochemical processes and influences in vegetation growth. PAR wavelength range is between 400 and 700 nm, being part of the visible light spectrum band (400-780 nm). This solar energy can be converted into biomass by photosynthesis in plants. Therefore, vegetation growth is directly related with solar radiation intensity and can be predicted with physical models. Two different models are normally implemented: one is based on photosynthetic photon flux density, Q_p (μmol·s^{-1}·m^{-2}) and the other is based on PAR (W·m^{-2}). Q_p is not often measured in regular meteorological stations, consequently the main objective of this study is to stablish a methodology to estimate Q_p from solar irradiation measurements, R_s (W/m^2). The experimental. Specifically, the average value of the ratio Q_p/R_s was calculated every 10 minutes, from experimental data measured between April 2019 and January 2020 in Burgos, obtaining a global mean value of 1.93±0.15 μmol· J^{-1} . The relationship between the ratio Q_p/R_s and the typology of the sky: clear, intermediate and overcast skies, accordingly to the CIE standard, is also analysed in this study. On the one hand, results show that there are statistically significant differences in the values of Q_p/R_s for each CIE standard sky type. On the other hand, aligned with other works in the bibliography, the overcast sky type shows the highest values of the ratio Q_p/R_s, contrary to clear and intermediate skies that show the lowest ratio.

Key words: *photosynthetic active radiation (PAR), vegetation growth, solar energy, sky types.*

MODIFICATION OF ENZYME ACTIVITIES IMMEDIATELY AFTER CONVERSION OF A MEADOW TO A FODDER MAIZE CROP

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Abstract

The EU Framework Program for Research and Innovation "Horizon Europe" establishes five missions, one of which is "Soil Health and Food". Among the objectives of this mission are to restore 50% of degraded land and to conserve and increase soil organic carbon stocks. It is therefore necessary to establish agricultural practices that are in line with this policy and will contribute to achieve this objective. In the temperate-humid zone of Spain, one of the most widespread crops is maize, which is currently used almost exclusively for fodder and is grown intensively. It is clear that this model has to change and move towards agricultural practices that involve sustainable soil management (reduction or elimination of inorganic fertilization, exclusive use of pesticides allowed in organic farming, use of mycorrhised maize seedlings, etc.). As part of a project, investigating farming practices that allow maintaining the production and quality of forage maize while promoting soil biodiversity and improving the soil ecosystem services, a meadow has been converted into a maize crop to assess the effect of this conversion on soil functionality. This work presents the first results of several hydrolytic enzymes and oxidoreductases determined in soil samples taken at two depths (0-5 and 5-10 cm) before and after land preparation and maize plantation. The results show that, in general, there was a significant impact of land-use change on soil enzyme activities, although the changes in enzyme activity were enzyme-dependent.

Keywords: *fodder maize, meadow, alternative cropping practices.*

SPATIAL ANALYSIS OF ARIDITY DURING GRAPEVINE GROWING SEASON IN eXTREMADURA, SOUTHWESTERN SPAIN

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Abstract

The grapevine is clearly affected by global warming. In this context, the distribution, quantity, and quality of water resources are changing, leading to different patterns of aridity which seriously affect Spanish vineyards. For this reason, a study of aridity in Extremadura, southwestern Spain, is essential. Extremadura is the second community with the largest vineyard area and, in addition, it has a Denomination of Origin (DO), Ribera del Guadiana, located in six subzones. The main objective of this study is the spatial analysis of aridity in Extremadura through the De Martonne index during the grapevine growing season in Ribera del Guadiana DO. The database for this research was obtained with the monthly maximum and minimum temperature and total precipitation data from the high-resolution climate projections for the period 1971-2005, provided by the meteorogical services of the Spanish government (AEMET). The De Martonne aridity index is based on the average temperature and precipitation, classifying the climate of a territory. This aridity index is calculated for the grapevine growing season from 1 April to 30 November. After the analysis of the spatial distribution of aridity in the DO Ribera del Guadiana, it has been obtained that the Cañamero sub-zone is characterized as humid and semi-humid, Montánchez as Mediterranean area and the rest of the sub-zones are semi-arid. Moreover, approximately 45.4% of the total area in Extremadura is semi-arid, 34.4% is Mediterranean, 8.5% is semi-humid, 5.7% is humid and 3.9% is very humid. The results of this study are of great importance for evaluating water deficit and water resources on local and regional scales in order to predict practical measures to control aridity in vulnerable areas.

Keywords: *Grapevine, Aridity Index, Extremadura.*

ANALYSIS OF THE EVOLUTION OF VINEYARD AREA IN EXTREMADURA (SOUTHWESTERN SPAIN) USING A GIS-BASED APPROACH. IS IT INFLUENCED BY CLIMATIC CHANGE?

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Abstract

An initial analysis about the influence of climate change on vineyard area in Extremadura (Southwestern Spain) is shown. Climate is considered, together with soil properties, the most important factor required to identify the suitability of an area for grapevine and wine production. The autonomous community of Extremadura has the largest grapevine-growing area in the south-western Iberian Peninsula, and one of the largest in Europe, and some wineries of international prestige are located there. This analysis was performed in a geographical information system (GIS) environment, using data, in shapefile format, from the land occupation information system in Spain (SIOSE) corresponding to 2005 and 2014. Vineyard areas were compared and reasons of the difference between 63 421 ha in 2005 and 110 832 ha in 2014 were analyzed. This evolution can be due to some technical changes, but it can also be due to the climate change, which has made some areas more suitable for wine-grape production, particularly those the Ribera del Guadiana Denomination of Origin (DO). Consequently, climate change can be one of the most important factors that influences on the increase of vineyards in Extremadura Results of this analysis is also useful to model the current and future potential distribution of vineyards in Extremadura, resulting of great interest as a agronomic and viticultural management tool, which can be used to advise farmers on what winegrape varieties are the most suitable in their geographical area, taking into account the current changing climate.

Keywords: *Vineyard, Geographical Information System, Climate Change*.

DELINEATION OF MANAGEMENT ZONES ON GRAZED PERMANENT PASTURES BASED ON THE RASCH MODEL

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Abstract

Areas with similar properties in agricultural or pasture fields have been delineated with many different algorithms. In this research, a new approach based on the formulation of the Rasch model, which is an objective and probabilistic model, is used. Different key soil properties are integrating, providing measures of soil fertility that can be used to analyze spatial pattern in the field. A case study in a pasture field comprised 76 soil samples of different sampling locations in a depth range of 0-0.30 m, taking into account that the depth of the roots in the pasture is around 0.2-0.3 m. These samples were analyzed for 10 soil properties: texture (i.e., sand, silt, and clay contents), nitrogen, phosphorus, potassium, organic matter, moisture content, pH, and soil apparent electrical conductivity. After processing the data with the Rasch model, and verifying that data fit the model reasonably, all sampling locations were classified according to their soil fertility and the influence of each soil property on the pasture soil fertility was also highlighted. Then, management zones were delineated using geostatistical techniques, identifying zones where inputs could be optimized, for instance, decrease in inputs in less fertile areas. Although the combination of the Rasch model and geostatistical techniques had been proposed in agricultural fields as a tool to developing an objective strategy to define management zones, it can also be used in pasture systems to analyze zonal differences. This information can be necessary to conduct site-specific treatments, leading to a more cost-effective and sustainable field management.

Keywords: *Homogeneous zones, Objective model, Spatial pattern, Soil fertility.*

SUSTAINABLE REMOVAL OF COPPER-OXYCHLORIDE BY CALCIUM ALGINATE BIOPOLYMERS

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Abstract

Recently it has been demonstrated that biosurfactants obtained from corn steep liquor (CSL) are able to solubilize copper-oxychloride (Cu-Oxy) in water up concentrations higher than 2 g/L. This is very interesting in order to obtain more green pesticides, where synthetic surfactants can be replaced by other more sustainable ones, the biosurfactants. However, it is important to evaluate if potential traces of Cu-Oxy in water streams could be removed by ecofriendly adsorbents, as possible strategy for the treatment of wastewater containing these biopesticides. The presence of biosurfactant, in the formulations of biopesticides, does not produce any environmental concern as the $t_{1/2}$ of this biosurfactant is lower than 30 days (corresponding to the time at which 50% of biosurfactant biodegradation is achieved). Biopesticide formulations were prepared using ultrapure water, using 4 g/L of pure Cu-Oxy or 8 g/L of the commercial pesticide which contains 50% of Cu-Oxy. These Cu-Oxy formulations were stabilized with 20 g/L of biosurfactant extract obtained from CSL. Once the biopesticide formulations were prepared, these were treated with calcium alginate beads, prepared with 2% of sodium alginate and 0.58 M of calcium chloride. Adsorption experiments were carried out at room temperature in a shaker, stirring during 30 min, with an agitation speed of 150 rpm. After wards, treated water samples were filtered and analyzed. The presence of Cu-Oxy was assessed by determining the content of Cu in the liquid solution, using Flame Atomic Absorption Spectrometry. Results showed that calcium alginate beads were able to remove 78.8 ± 0.1% of Cu from wastewater when the pure active principle was used and 61.7 ± 0.3% when the commercial pesticide was employed, observing that the adsorbent under evaluation, based on calcium alginate beads, possessed an interesting potential as sustainable adsorbent in case that Cu-Oxy reaches wastewater streams.

Keyword: *copper, biosurfactant, pesticides, wastewataer, bioadsorbent.*

ANALYSIS OF TEMPORAL TRENDS FOR DAYS WITH OPTIMUM TEMPERATURES FOR GRAPEVINE GROWING IN THE RIBERA DEL GUADIANA DENOMINATION OF ORIGIN (SPAIN)

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Abstract

It is essential in viticulture to know the climatic conditions and temporal trends, particularly in the current global warming. The Ribera del Guadiana Denomination of Origin (DO) was established with six wine-growing subzones located in Extremadura (Southwestern Spain). More than 90% of the vineyards in Extremadura are in these subzones. Extremadura ranks also the second in Spain. The main objective of this study was to analyze the influence of climate change on the number of days with optimum temperatures for grapevine growing (ODW) in the Ribera del Guadiana DO. Dataset used in the present study was generated with data from daily maximum and minimum temperature, at the six meteorological stations located in each subzone,obtained from the meteorological services of the Spanish government (AEMET) for the period between 1989 and 2018. The ODW are those in which the mean daily temperature is between 19^{o}C and 27^{o}C. Thus, the ODW (from 1 April to 31 October) and also for April, May, June, July, August, September and October, were computed. It was obtained that the mean number of ODW is 108, ranging from 100 in Matanegra and 118 in Ribera Alta. Only three optimum days were calculated in April; in contrast, the highest number of optimum days were computed in September and June, with 23 and 20, respectively. This was due to the fact that days with mean temperatures higher than 27^{o}C were more frequent during these months. Results have shown significant increasing trend in the number ODW in Cañamero and Montanchez, but a decreasing trend was evident in Tierra de Barros. Moreover, significant decreasing trends were found in June for Ribera Alta, which was due to the important number of days with high temperatures.

Keywords: *Vineyard,Trends, Temperature, Extremadura.*

POTENTIAL EFFECTS OF MINIMUM AND MAXIMUM TEMPERATURE INCREASE ON GRAPEVINE IN EXTREMADURA (SPAIN)

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Abstract

Climate variations in Extremadura (Spain) have significant impacts on economic sectors such as agriculture and livestock. These variations are due to an increase in temperatures in the period 1989-2018. This increase will have long-term effects on the vineyard and also evidence of whether global warming will change precipitation in the region; or whether these changes will be evidence that may respond to climate variability in the region. Temperature plays a crucial role in grape production and wine quality, as its variations in monthly and extreme values can impact the future of agriculture and viticulture. Temperature increases can produce earlier grape ripening, therefore temperature changes affect how grapes ripen, if the temperature range variation is small the grapes will lack acidity, while if the difference is large the grapes will contain higher acidity. These trend increases are found in different areas of Extremadura, so to carry out this work the trend variations of three variables, monthly precipitation (Rr), average monthly maximum temperature (Tx) and monthly minimum (Tn), were analyzed data from 118 meteorological stations, distributed throughout the Extremadura region, were used and the Mann-Kendall test and Sen's slope were applied to identify the direction and magnitude of the trends. Results indicate a high interannual variability in Tn and Tx, with positive trends. However, no annual trends were observed in Rr. These findings indicate potential disruption of climate–variety balance, increasing water stress, and challenges in producing quality wines without the adoption of appropriate adaptive measures.

Keywords: *vineyard, climate change, trends, ordinary kriging.*

EFFECT OF NITROGEN FERTILIZATION ON TRITICALE GROWN FOR DUAL PURPOSEOF FORAGE PLUS GRAIN IN SEMI-ARID ENVIRONMENT

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Abstract

In Tunisia, lack of forage is one of the most important problems of livestock feeding during the autumn and winter seasons. One of the solutions is the practice of dual-purpose cereals; cereals are grazed or cut at a young stage (tillering) and then allowed to re-grow up to grain production. Effect of application of three Nitrogen fertilization rates (0, 75 and 175 kg/ha) on Triticale variety Tcl 83 grown for grain production only and for the dual purpose of forage plus grain was studied in semi-arid region in Tunisia during 2018-2019 cropping season. Removal of forage for the dual purpose treatment was done at the pseudo stem erect stage (C30). Variance Analysis showed that Tillers number/plant, spike number/m^2 and grain yield were significantly ($P<0.01$) influenced by the combined effect N fertilization and cutting at (C30) stage. This experiment has also shown that dual-purpose cultivation affected positively the grain protein content and nitrogen regime has a significant effect on thousand-kernel weight of the triticale produced at maturity stage. As per 2018-2019, when climatic conditions were favorable, The dual-purpose use of triticale could constitute a solution for the winter feed gap in the livestock cycle provided that adaptations of the traditional crop management to dual purpose, such as the sufficient nitrogen fertilization are undertaken.

Keywords: *Triticale, Dual purpose, Nitrogen, Semi-arid*.

POTENTIAL AND POSSIBILITY OF CONVERTING AGRICULTURAL WASTES TO BENEFICIALLY SUSTAINABLE ENERGY AND MANURE IN TURKEY

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Abstract

Turkey is one of the 20 largest economy countries all over the world as it is ranked 18th but in terms of agriculture production and its economy Turkey is positioned among the top 10 countries to provide agricultural production such as different types of crops and other fruits and also animal productions namely livestock, cattle and poultry. The rate of crop production is 71.3% and animal product rate is 28.7%. The main aim of this research is about converting agriculture namely plant and animal wastes and residues to provide energy in the future. Turkey has so many potential agriculture farming and agriculture productions in terms of field crops and animal production.Therefore, it is important for researchers to think about doing research on this area. This study can be done in Samsun province, it is one of the biggest cities in Black Sea zone in Turkey which is surrounded by so many farms and has many animals.Therefore, it is important in this research to collect data and find out potential information about these productions. Samsun City is also surrounded by so many towns. In Turkey, agricultural and 77% of the animal waste potential is made of animal. Conducted within the scope of solid waste management in our country, research has shown that animal manure has been affected by incorrect applications. Biochar production from biological waste and the soil alertness will increase the reputation of its implementation, considering that more than half of its zone is consisting of agricultural and forestry areas (58%) and therefore, having high biomass possibility in Turkey.

Key words: *potential waste, agricultural productions and utilization residues.*

THE RELATIONSHIP OF GLOBAL CLIMATE CHANGE WITH AGRICULTURE AND ENVIRONMENT

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Abstract

The demand for needs increases with the world population. The whole world is affected directly or indirectly while meeting the needs. The composition of atmosphere deteriorates as a result of human activities. This situation is an important problem that confronts us as global climate change. The aim of study is to examine the sectoral relationship of global climate change in Turkey. In addition, it is to reveal the effects on agriculture and environment. Excessive and unconscious use of fossil fuels and industrialization have an impact on climate change. Climate change has serious impacts such as drought, desertification, erosion and disruption of natural balance all over the world. It indirectly threatens sustainability in agriculture. It endangers the production and nutrition necessary for life. People unknowingly cause greater problems. Climate change affects socio-economic sectors and ecological balance. Its effects such as excessive rainfall, depletion of water resources, insufficiency of plant nutrients adversely affect agricultural activities. However, it is thought that the negative effects will be reduced with different methods used in agriculture such as organic farming, drip irrigation, land consolidation and use of renewable energy. Climate change, which is a global problem, can only be reduced by global measures.

Keywords: *Climate change, ecology, agriculture, environment, sustainability.*

DETERMINATION OF ENTERIC METHANE EMISSIONS AMOUNT FROM SHEEP BREEDING BETWEEN 2004-2020 IN TURKEY

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Abstract

Animal production is one of the most important sources of methane (CH_4) emissions in agriculture. Especially, ruminant livestock animals account for the majority of global anthropogenic methane emissions. The primary sources of methane emissions from livestock animals are microbial fermentation (80%) and manure (20%). Methane is a serious greenhouse gas with 25 times the effect of carbon dioxide (CO_2). Therefore, its impact on global warming cannot be ignored. Sheep breeding is common in Turkey as it requires less capital and investment, creates labour capital in the region where it is made, adapts quickly to climate conditions and is a preferred source of animal protein. According to the Turkish Statistical Institute (TUIK) data, the sheep population has increased by 66% in the last 17 years. In this study, enteric methane emissions from sheep production in Turkey in the last seventeen years were determined by the Tier-2 method determined by the Intergovernmental Panel on Climate Change (IPCC). Methane emission factor (EF) was determined on average 11.9 kg CH_4/head/year, and the gross energy was determined 33.3 MJ/day. Accordingly, enteric methane emissions from sheep breeding have increased by 72.9% since 2004, and it has been calculated that 517 kilotonnes of CH_4 emissions were realized in 2020. It is predicted that the increase in emissions will continue depending on the increase in sheep numbers for the following years. For this reason, effective precaution should be taken on a farms basis or nationwide to reduce enteric methane emissions. Scientists need to focus more on this issue.

Keywords: *Enteric fermentation, Methane, Sheep, Tier-2, Turkey.*

ASH CONTENT OF SOME OAK SPECIES

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Abstract

Oak, which is a member of the Fagaceae family, has a wide distribution in Turkey and there are 18 oak species naturally. They are mostly trees, some are tall shrubs, deciduous or evergreen plants in winter. The general area of oak forests in Turkey is 5.152.561.8 hectares in total. Oaks are divided into three groups as white oaks, red oaks and evergreen oaks according to the anatomical structure of their wood, leaf and bark characteristics and the ripening time of their fruits. Oak is valuable for Turkey in terms of species diversity, the area it covers, the use of wood and by-products. Oaks are used in areas such as furniture, plywood, carving, parquet, and building materials. Within the scope of this study, ash determination tests in oak woods were carried out from stem-woods. The ash amounts of sessile oak *(Quercus petraea)*, Hungarian oak *(Quercus frainetto)* and brash (Turkish) oak *(Quercus cerris)* were determined and the ash amounts were found to be respectively 0,41%, 0,51% and 0,57%. It was measured that the average ash amounts of oak species was 0,49%. When the average ash amounts of oak species we compared with broadleaves species ash amounts; it was determined that ash, poplar, maple, alder values we close to each other. Average ash of oak species, it is higher than coniferous species and higher than oak and beech, and lower than chestnut in the Fagaceae family. It is suggested that oak ash can be used in agriculture and soil nutrition for plants.

Keywords: *Wood ash, Fagaceae, Oak, Oak ash.*

THE QUALITY PARAMETERS OF RECYCLED PAPER

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Abstract

The use of waste paper as a raw material in the production of paper and cardboard is increasing day by day. Recycled paper is obtained by collecting and classifying waste paper and repulping it through the recycling process. The most commonly used waste paper types in recycling process are old corrugated cardboard, white office paper, old newspapers and magazine paper and waste paper mix consisting of a mixture of one or both of them. Non-fiber resources that vary according to the type of waste paper are removed in recycling processes. The heterogeneous waste paper raw material is desirable to form homogeneous pulp suitable for paper production. Recycling of waste paper and cardboard provide a new product with economic added value and appreciation. Increasing the production of recycled papers decreases the cutting of trees and this ensures the sustainability of forests and prevents the releases of hazardous chemicals to environment. Knowing the impact on quality parameters is important to analyze changes in fibers obtained from waste paper and cardboard recycling. Recycled fibers are rigid and more fragile than virgin fibers because they lose their flexibility. The bonding potential in the fibers is lesser and their surface areas are narrow and swelling properties of fibers are low. As they have undergone hornification, their breaking length and burst strength are low, while tear strength is high. Since the fine fibers are abounding, their opacity is high and their brightness is low. Ash content of recycled papers differs according to type of waste paper.

Keywords: *Waste papers, Recycled papers, Recycled fibers, Fiber morphology.*

FIBER PROPERTIES OF *RUMEKS CRISPUS* L. ROOT

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Abstract

A global shortage of conventional pulpable raw material is seen there were attempt in this century. Search for new fiber annual wood sources against hardwood has been underway during the last few decades. On the other hand, there were attempt to find and develop new fiber supplies such as wood particularly annual plants for paper and pulp industries. *Rumex crispus* L. plant is widely available in Turkey. Its extracts are known to have antimicrobial properties. It is thought that *Rumex* crispus will be used in the production of special papers due to its antimicrobial properties and also to obtain dyes. The anatomical image was taken in cross-section from the tubers of *Rumex crispus* L. and its relation to the fiber structure was investigated. Depending on the fiber properties obtained, the potential of these types to be used as raw material in paper production has been evaluated and discussed. Therefore, according to Shultze method were macerated *Rumex crispus* L. root samples and prepared microscopic slides for measuring fiber dimensions. In tests, fiber length, fiber width (diameter), lumen diameter and cell wall thickness were measured. When the fiber lengths of *Rumex crispus* L. annual plant are compared with annual plants such as hemp, barley straw, oat straw, rye straw, which are still in use, the shorter fiber dimensions show that it will allow its use in pulp like these plants. Also, it can be said that the pulp obtained from *Rumex cripus* L. which has a yellow pigment feature, can be used in the production of artistic special papers.

Key words: *Fiber properties, Rumex crispus* L., *annual plants, pulp, paper.*

INVESTIGATION OF LANDSCAPE CHARACTERISTICS OF DÜZCE PROVINCE, AKÇAKOCA DISTRICT IN THE SCOPE OF ECOTOURISM AND DEVELOPMENT OF ECOTOURISM RESOURCES

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Abstract

Ecotourism started when local farmers opened a part of their houses to tourists going to the Alps for the first time, and is defined as "enjoying and appreciating nature". Ecotourism, which is one of the alternative tourism types, has come to the forefront with its functions such as protecting natural areas, income generation, education, participation of local people and especially protecting the ecosystem, as well as benefiting from natural areas since the beginning of the 1990s. Today, in order to balance the interregional development levels, to increase the income obtained from tourism and to use the natural, cultural and historical attractions in almost every part of the country as an alternative, alternative tourism activities have started to be directed. Düzce Province, which is within daily transportation distance to Istanbul and Ankara metropolises, is a very rich area in terms of natural, historical and cultural tourism and recreation resources: surface waters, plateaus, picnic and recreation areas, camping areas, etc. It has rich ecotourism diversity with its destinations, affordable prices and access opportunities. Akçakoca district of Düzce province is located in the Western Black Sea Region and is the only district of Düzce province that has a coastline. Akçakoca is 38 km from Düzce city center. It is away 270km and 235 km from Ankara and Istanbul, two important metropolises of Turkey, respectively. Considered within the 2023 Turkey Tourism Strategy, Akçakoca is an important district of Düzce, which is rapidly losing its natural and cultural resources as a result of wrong land uses and tourism policies. Akçakoca, which has been in demand as an important tourism area of Turkey since the 1940s, has gradually lost its value. Emphasizing that while planning, the planning should be made by taking into account the effects of this type of tourism on nature, natural life, local people and national economy, in line with the protection, use and transfer of the natural environment to future generations with a sustainable approach that does not harm the ecological balance, and within the framework of the ecotourism approach, suggestions have been developed on developing ecotourism resources. In the context of sustainable ecotourism, in order to obtain a sustainable tourism model in which protection-use balance is provided, it has been tried to contribute to the production of alternative solutions. The study is important in terms of giving an idea about the ecotourism of the region, developing ecotourism resources, revealing the contributions to the regional tourism and offering solutions for it.

Keywords: *Ecotourism, Ecological Resource, Sustainable tourism, Düzce, Akçakoca, Planning.*

DENSITY AND HABITAT PREFERENCE OF AN INVASIVE SPECIES (*Diadema setosum*, Leske, 1778) IN THE MEDITERRANEAN SEA

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Abstract

Sea urchins are important members of benthic communities by impacting algal production and therefore the other members of the communities. A member of these organisms, *Diadema setosum* Leske, 1778, was introduced to Mediterranean Sea in 2006 and it has extended its distribution to various localities. However, previous studies on this invasive species have only focused on its occurrences in different parts of the Mediterranean Sea. Here, we conducted an observational study on the density of this sea urchin at six sites along the Turkish coast of Aegean Sea differing in the habitat types. Additionally, we determined the density of a native sea urchin, *Arbacia lixula* Linnaeus 1758, at the same sites to reveal the potential interactions between these two species. We found that *D. setosum* reached a notable density on the Turkish coast of Aegean Sea and this density was higher at the sites with hard bottoms. We further found an inverse relationship between the densities of *D. setosum* and of *A. lixula*. Overall, this study emphasizes the need of an urgent management/conservation plan since *D. setosum* has already reached the previously reported threshold density at which it is harmful to benthic communities in the Mediterranean Sea.

Keywords: *Arbacia lixula, competition, Diadema setosum, Mediterranean Sea, sea urchin.*

ASSESSEMENT OF WATER AND ECONOMIC PRODUCTIVITY IN IRRIGATION MANAGEMENT

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Abstract

Irrigation is extremely important for food security and reducing the risk of drought. Approximately 70% of water is used in irrigation at a global level. The quantity and quality of water resources are decreasing due to climate change, increasing population and frequent droughts. This requires the reduction and efficient use of water used in agricultural irrigation. For this reason, the crop yield to be obtained by additional irrigation water applied considering the irrigation and operating costs and net margin per unit land area-NM (US$ ha^{-1}) as well as the irrigation water productivity-WP_I (kg m^{-3}) and net economical water productivity- $NEWP_I$ (US$ m^{-3}) are also important components for assessment of irrigation schemes. Because, the farmers and irrigation schemes are an economic enterprise that aim at higher profit by increasing the yield to be obtained from the unit area. In addition, WP_I is also an indicator of whether the irrigation water is used effectively. However, the water productivity begins to decline while irrigation water yields increase. Connecting this approach, the right of the intersection of the irrigation water-yield curve and the irrigation water-water productivity curve shows unnecessary excess irrigation water application. Thus, it can be decided at which point the irrigation can be stopped. This can give more optimal irrigation strategy. In this article, the relationships between WP_I, $NEWP_I$ and NM are evaluated and discussed using some experimental results in semi-arid regions.

Key words: *water productivity, water economic productivity, irrigation management*.

UNDERSTANDING THE RELATIONSHIP AMONG GEOMORPHOMETRY, SPECTRAL INDICES, AND SOME SOIL PROPERTIES IN A WATERSHED SCALE

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Abstract

This research aims to provide an understanding of the complex ecological relationships with geomorphometry, remote sensing (RS) indexes and some soil features in watershed scale. The study was carried out in an area of 9950 ha watershed in Erzurum, Turkey. Sentinel-2 MSI data were used for mapping spectral indices such as; NDVI, NDWI, NDMI, soil bare index (SBI). Digital elevation model (DEM) was used to mapping transportation capacity index (TCI), stream power index (SPI), compound topographic index (CTI), curvature, slope, and altitude. Some soil physical and chemical properties were analyzed using 120 topsoils (0-30 cm). According to the results, the highest correlation ($p<0.01$) was found between slope and NDVI (-0.410), NDWI (0.386), NDMI (-0.372), SBI (0.384), pH (0.163) and, Na (0.174). The highest correlation ($p<0.05$) was found between CTI and NDVI (0.358), NDWI (-0.336), NDMI (0.372), SBI (-0.298), pH (-0.165), and phosphorus (0.164). The highest correlation ($p<0.01$) was found between SPI, and Phosphorus (0.301). The highest correlation was found between altitude and CTI. In this study, the most important variable was the altitude effected on morphometric characteristics, spectral indices, and soil properties. In previous studies, CTI had been used to model the spatial model of potential soil moisture and to identify areas susceptible to erosion and landslides. In this study, especially the effect of topography on hydrological processes on nutrients was determined.

Keywords: *Geomorphometry, GIS, RS, Soil ecology, Watershed.*

SEED-ENHANCEMENT TECHNOLOGIES FOR ENHANCING SUSTAINABLE RESTORING OF THE ARID-LANDS

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Abstract

Sustainable agriculture in desert environments faces several challenges, such as high temperatures, soil salinity, water scarcity, loose soils that have low water holding capacity and soil nutrients, etc. Seed and seedling are the most critical stages that affect plant establishment under hot-arid desert conditions. However, serval seed-enablement technologies (SETs) are attempting successful germination and seedling establishment in hot-arid deserts. SETs introduce techniques that allow for the physical manipulation and application of materials to the seed that can enhance germination, emergence, alleviate the effect of stresses experienced during both abiotic and biotic stress and/or early seedling growth. This article reviewed the different SETs, namely, seedballs, seed pellets, encrusting, film-coating, priming, seed cube, seed briquettes, clay dumplings, encapsulation, seed conglomeration, seed pillow, etc. The SETs enhance the level and speed of seed germination through priming and create a proper seed microenvironment, such as improving water and nutrient contents, that enhance seedling establishment. The general trend in the literature indicates that the components of SETs determine the proper technique and its subsequent success. The components of the SETs also protect seeds from granivores. They can also adjust some of the seed's physical attributes to match mechanization requirements (e.g., size, shape, weight). It is recommended to integrate different SETs, especially since each technology tends to be species-specific. The study will help solve problems in agricultural systems and the ecological restoration of degraded ecosystems.

Keywords: *Seed-Enablement Technologies, Ecological restoration, Seed Priming, Seed coating, Seedling establishment.*

IMPACT OF AGRICULTURAL RUNOFF OF PHOSPHORUS IN COASTAL WATER QUALITY

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Abstract

Phosphorus (P) loss from agricultural fields is a major cause of water quality problem around the world. Relative impacts of different sources of P including agricultural, geologic, and recycling/remobilization, are poorly constrained mainly due to methodological constraints. We analyze dissolved, suspended particulate matter, and sediment-bound P in the surface water, porewater, and sediment to develop the source-sink relationship of P in an ecosystem. In agricultural soils, where P application usually exceeds the agronomic needs, readily available P pools were found to be transformed into more recalcitrant P pools. Among different P sources in a watershed that can impact downstream water quality, agricultural fields, streambanks, and river bottom sediments were found to be major sources, but their relative roles varied at the upstream and downstream portion of the creek. Tides are found to play two primary functions—forming particulate matter from estuarine sources and importing upstream and diluting the P load from headwater. These findings provide an improved understanding of sources and biogeochemical processes of P in upland soils and loss to open waters and competing needs of resources (e.g., crop and water) that are useful to identify ways to evaluate the trade-off and minimize undesirable consequences.

Key words: *agricultural runoff, water quality.*

5.ANIMAL HUSBANDRY

NUTRITIONAL VALUE OF GRASSLAND MEADOW GRASS GRAZED BY DAIRY COWS

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Abstract

The chemical composition of forages and food is the first essential step to valorize animal feed; it allows us to estimate the nutritional value of food. The present study focused on determining the chemical composition of grass grazed during the spring of 2018 by dairy cows at the beginning of the 2nd cycle (grass 1) and at the end of the 2nd cycle (grass 2). The dosage of this herb indicates the following levels respectively: green dry matter (GDM): 18.14% and 21.66%; mineral substances (SM): 10.45% and 10%; Crude fibber (CF): 26.53% and 24.24% and total nitrogenous matter (TNM): 14.52% DM and 16.61% DM. From these analyses, we were able to deduce the nutritional value of these samples by using the PrivAlim software. Results obtained: the energy value expressed in milk feed unit (MFU): 0.84 and 0.90, in feed unit meat (Meat UF):0.78/Kg DM and 0.86/Kg DM and the nitrogen value represented by digestible proteins in the intestine (g of PDI). When the limiting factor is nitrogen, the DPIN value is 97g and 112 g, and if the limiting factor is energy, the DPIE value is 96 g/kg DM and 103 g/kg DM.

Key words: *grazed grass, chemical composition, energy value, nitrogen value.*

FARM CHICKEN ISA F15 STRAIN MONITORING IN THE TABLAT REGION (WILAYA DE MEDEA) ALGERIA

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Abstract

Obtaining good zootechnical performance in broiler rearing requires continuous and regular monitoring throughout the rearing period to increase the profitability of the rearing. The objective of this work is to compare the zootechnical performance of a broiler farm consisting of the ISA F15 strain against the standard of the latter. Our study was carried out in the commune of Tablat (wilaya of MEDEA) for a period of 56 days and which consisted of monitoring a broiler farm consisting of 1,700 one-day old chicks (ISA F15 strain). The results obtained for the consumption index (CI), the mean daily gain (GQM), and the mortality rate (MT) were (CI = 3.64), (GQM = 42.23g / d) and (TM = 10.64%), Respectively. The technical results obtained by the present study concerning the mortality rate, the consumption index as well as the weight gain were really incomparable with the standards of the strain, given the poor application of the breeding behavior by the breeder. However, despite the application and compliance with all sanitary and hygiene measures (vaccination, disinfection), there is the emergence of diseases causing high mortality rates which decrease following the initiation of treatment. In poultry farming, the most effective way to prevent economic losses caused by diseases remains good compliance with standards of breeding behavior.

Keywords: *Farm monitoring, Broiler, ISA F15 strain, Zootechnical performance, Mortality, commune of Tablat (wilaya of Medea), ALGERIA.*

THE HEALTH STATUS OF FOOT AND UDDER AT THE LEVEL OF DAIRY FARMS IN THE COMMUNE OF SIDI MHAMED BENALI

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Abstract

Among the dairy cattle production problems, mastitis and lameness rank first in terms of socio-economic impact. Our objectif is assessment of the state of well-being of the udder and the foot in dairy cows and its relationship with milk production associated with the identification of risk factors in dairy farms in the wilaya of Relizane. A sample of 42 Prim Holstein and Montbéliard dairy cows in second lactation was used for milk analysis by pH paper test and for locomotion index determination. A sanitary and hygienic score of the mammary gland and of the foot was carried out on the day of the visit. The results obtained show that the average quantity of milk produced by healthy cows is greater than that produced by cows infected at the rate of (14.90; 10.5) L / d respectively with a $p < 0.05$. The locomotion index score made it possible to determine the lame and non-lame cows.The rate of lame cows observed was 21.42%, the latter is above the recommended alert threshold and that must be less than 15 %. Lame cows presented a greater score for hoof growth and angle plumb than non-lame cows at the rate of (1.11; 0.22) and (1.61; 0.83) respectively with a $p < 0.05$. The use of the pH paper test established a mastitis prevalence of 47.61%. The teat health score was higher in cows with mastitis than in healthy cows to a value of (0.81, 0) respectively with a ($p \leq 0.05$) and the score 5 of the line mammary is determined as the best position score of the mammary gland to avoid the appearance of teat lesions.The score for the hygienic condition of the udder was higher in sick cows than in healthy cows to a value of (3.11 , 2) with a very significant mean difference ($p \leq 0.05$). In conclusion the evaluation of the well-being of the foot and the udder reveals that the conditions for raising dairy cows are not satisfactory and there is no respect of the animal's welfare.

Keywords: *Animal welfare; dairy cattle; audit; lameness; mastitis.*

FACTORS AFFECTING BIRTH WEIGHT OF ALGERIAN ARABIA GOATS KIDS REARED UNDER EXTENSIVE PRODUCTION SYSTEM

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Abstract

The Arabia goats are the most common indigenous breed in Algeria due to their ability to adapt under harsh environmental condition. Only a few studies has characterized the native breeds of this region. The present paper aims to study the factors affecting the birth weight of Arabia goat kids which have an important role in growth of offspring. A total of 474 kids were weighed immediately after birth from nine farms during two season of kidding. Data for each kid born were recorded, including sex, litter size, round parity, year, month and date of kidding and then correlated with birth weight. The results showed that birth weight was 2.63±0.31 Kg with a significant difference between sex (2.69±0.32 Kg vs 2.6±0.3 Kg for male and female respectively). At birth, the sex ratio was female-biased (310/164). Kids born as single were clearly heavier (2.91±0.34 Kg) than those born as twins and triplets (2.61±0.26 Kg and 2.33±0.27 Kg respectively). Our study revealed a positive relationship between round parity and birth weight of kids. Multiparity is associated with an increase of birth weight. Also kidding season had a significant effect on birth weight. November and December provide the heaviest kids. This might attributed to high pasture biomass production during this period, on the other hand kids born in February to March was lighter which due especially to fodder scarcity, hence the importance of gather kidding between November and December is desired.

Keywords: *Arabia goat, birthweight, sex, parity, Algeria.*

ISOLATION AND ANTIBIOTIC RESISTANCE OF *SALMONELLA* IN ALGERIAN BROILER SECTOR

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Abstract

In Algeria, the Algerian poultry consumption has grown remarkably during these last three decades because of its competitive price as well as livestock investment development in private and state sectors. This development has been associated with recrudescence of several infectious diseases, mainly zoonosis. In this context, salmonellosis has appeared as one of the main causes of economic losses in broilers and laying hens across the country. The study was conducted to determine the *Salmonella* status of broiler farms and hatcheries in the Central region of Algeria. A total of 473 samples were collected and analyzed according to the method ISO 6579. The number of positive cases was 17 (a rate of 3.6%) with the presence of three serotypes *Salmonella Kedougou*, *S. Virchow* and *S. Enteritidis*. Most cases were observed in breeders and one-day old chickens. Subsequently, antibiograms were performed to determine the susceptibility pattern of strains isolated, 100% of strains were sensitive to at least two antibiotics mostly used, namely amoxicillin, ceftiofur, colistin and sulfamethoxazole-trimethoprim. The present data support the persistent need of conducting well designed studies, aiming the well estimation of salmonellosis prevalence in the main domestic avian species.

Keywords: *Salmonella spp., poultry, zoonosis.*

ISOLATION AND ANTIBIOTIC RESISTANCE OF SALMONELLA IN ALGERIAN BROILER SECTOR

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Abstract

In Algeria, the national poultry consumption has grown remarkably during these last three decades because of its competitive price as well as livestock investment development in private and state sectors. This development has been associated with recrudescence of several infectious diseases, mainly zoonosis. In this context, salmonellosis has appeared as one of the main causes of economic losses in broilers and laying hens across the country. The study was conducted between 2018 and 2019 to determine the *Salmonella* status of broiler farms and hatcheries in the Central region of Algeria. A total of 473 samples were collected and analyzed according to the method ISO 6579. The number of positive cases was 17 (a rate of 3.6%) with the presence of three serotypes Salmonella Kedougou, S. Virchow and S. Enteritidis. Most cases were observed in breeders and one-day old chickens. Subsequently, antibiograms were performed to determine the susceptibility pattern of strains isolated, 100% of strains were sensitive to at least two antibiotics mostly used, namely amoxicillin, ceftiofur, colistin and sulfamethoxazole-trimethoprim. The present data support the persistent need of conducting well designed studies, aiming the well estimation of salmonellosis prevalence in the main domestic avian species.

Keywords: *Salmonella spp., poultry, zoonosis, Algeria.*

DAILY BEHAVIOR OF LOCAL BREED CATTLE AT THE AULNAIE OF AIN KHIAR DURING THE SUMMER

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Abstract

The alder grove is a characteristic environment of the wetland of El Tarf. This ecosystem is now exposed mainly to free grazing by local cattle. The aim of this work is the determination of the diurnal behavior of cows of local breed "Brown Atlas" at the level in the alder grove of Ain Khiar. For this purpose, 5 cows were daily followed for 10 days to determine their feeding activities and their behavior during the summer. During the summer, the animals are locked up at night in the sheepfold and go out to the pasture at dawn. They roam all the plots chosen by the shepherd for a total of 14 hours per day. However, their feeding activities are restricted to 8 hours of feeding (57% of total time). In addition, during the hottest hours, the animals are parked in a make shift pen in the middle of the forest, and the rest of the time, the animals spend resting, which is 37% of the total time. As for the choice of food, the animals are restricted to single species of *Typha latifolia* (L, 1753). The body condition score of the animals decreases considerably during the summer and can go down to 2 or 1,5.

Keywords: *Alder grove, cattle, feeding Behaviour, Paturage.*

NUTRITIONAL VALUE OF GRASSLAND MEADOW GRASS GRAZED BY DAIRY COWS BY USING PRIVALIM SOTWARE

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Abstract

The chemical composition of forages and food is the first essential step to valorize animal feed; it allows us to estimate the nutritional value of food. The present study focused on determining the chemical composition of grass grazed during the spring of 2018 by dairy cows at the beginning of the 2nd cycle (grass 1) and at the end of the 2nd cycle (grass 2). The dry matter (DM), mineral matter (MM), total nitrogenous matter (MAT) and crude fibber (CB) content were determined according to the AOAC (1990) methods. The calculation of the nutritive value of grass samples taken, energy (UFL) and nitrogen (PDI), it was estimated from the chemical composition using PrévAlim software. The dosage of this herb indicates the following levels respectively: green dry matter (GDM): 18.14% and 21.66%; mineral substances (SM): 10.45% and 10%; Crude fibber (CF): 26.53% and 24.24% and total nitrogenous matter (TNM): 14.52% DM and 16.61% DM. From these analyses, we were able to deduce the nutritional value of these samples by using the PrivAlim software: the energy value expressed in milk feed unit (MFU): 0.84 and 0.90, in feed unit meat (Meat UF):0.78/Kg DM and 0.86/Kg DM and the nitrogen value represented by digestible proteins in the intestine (g of PDI). When the limiting factor was nitrogen, the DPIN value of the beginning of the 2nd cycle (grass 1) and the end of the 2nd cycle (grass 2) was 97g and 112 g respectively, and if the limiting factor was energy, the DPIE value was 96 g/kg DM and 103 g/kg DM.

Keywords: *grazed grass, chemical composition, energy value, nitrogen value.*

BACTERIAL ECTOMICROFLORA OF *VARROA DESTRUCTOR*, ECTOPARASITE OF HONEYBEE, COLLECTED IN THE APIARY OF BOUMERDES (ALGERIA)

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Abstract

Varroa destructor Anderson and Trueman (Acari: Varroadae), previously known as *Varroa jacobsoni*, is an important pest of the honeybee, *Apis mellifera* L. It has been causing severe damage to populations of this species worldwide in recent years. The aim of this work was the isolation and identification of the bacterial ectomicroflora of the *Varroa destructor*, an ectoparasite of the bee (*Apis mellifera* L). Samples of *Varroa* were collected from the location of Boumerdes (situated in northern Algeria) beehive summer debris. The ectoparasitic honeybee *Varroa* was desinfected with 70% ethanol and then it was spread in nutrient agar plates. For the isolation and identification of the bacteria, the macroscopic and microscopic characters were done according to Bergey's manual of systematic Bacteriology. Biochemical characteristics were tested by using API 20E galleries (Biomerieux). The experiments were performed twice. The results of the preliminary study showed that the ectoparasite harbored 7 genera of bacteria: *Staphylococcus* sp (3), *Bacillus* sp (2) and *Pseudomonas* sp (2). The colonies of *Staphylococcus* are Gram positive, mobile, coccoid shaped, aero-anaerobic and with a positive catalase. *Bacillus* are Gram-staining-positive rods, mobile, endospore forming, aerobes or facultative anaerobic and can produce catalase and oxidase. *Pseudomonas* bacteria are Gram-negative, oxidase-positive, strict aerobic and non-spore forming. The knowledge of microbial microflora opens up prospects for integrated control.

Key words: *Apis mellifera L, Varroa destructor, bacterial ectomicroflora, biochemical characteristics.*

EFFECT OF *VARROA DESTRUCTOR* ON THE HIND WINGS AND ON THE PHYSIOLOGY OF THE WORKER HONEYBEE (*APIS MELLIFERA INTERMISSA*)

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Abstract

Varroa destructor (Anderson) (Acari: Varrroidae) is an ectoparasite of the honeybee (*Apis mellifera* L) in the brood and adult stage. It causes serious damage to the colonies. This work aims to study the influence of this ectoparasite on the hind wings and on the hemolymphatic metabolites of the worker bee. The determination of the hemolymphatic proteins and carbohydrates of healthy and parasitized workers was carried out respectively according to the method of Bradford (1976); Duchateau and Florkin (1959). Nine morphometric characters are retained. These are the dimensions of the right hind wing, the number and extent of the hamuli, the wing veins (3), the length of the jugal and the vannal lobes. The results obtained show that 55.55% of the morphometric characters are affected by this mite. Infestation with this haematophagus has a significant impact on the haemolymphatic protein and carbohydrates of parasitized nurses compared to healthy bees.

Key words: *Apis mellifera intermissa*, *Varroa destructor*, *morphometry, Hind wing*, *hemolymphatic metabolites*.

STUDY OF THE ANTIBIOTICS AND SYMBIOTIC EFFECTS ON SPERMATIC QUALITY BY THE CASA SYSTEM

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Abstract

The objective of the current work was to study in vitro the sperm quality after antibiotics and symbiotic addition and to evaluate a treatment shortly administered before insemination in order to reduce artificial insemination failures (AI) in goats. Our experimental study was carried out at the Laboratory of Biotechnologies related to animal reproduction (Blida, Algeria). Semen analysis was performed by the CASA system (Computer-assisted sperm analysis). We used for the first experimental approach, the antibiotics most commonly administered in veterinary field for the treatment of subclinical endometritis (SCE). A total of eight antibiotics were studied. Each antibiotic tested was co-incubated with frozen goat semen brought from the Center for Artificial Insemination and Genetic Improvement (CNIAAG). For the second approach, we co-incubated the seed with a symbiotic (Symbiovéba). Finally, we selected two antibiotics among those used, namely colistin and cotrimoxasol; we co-incubated them with the symbiotic and the semen, to try to find a possibility of combining antibiotics with symbiotics in the treatment and prevention of uterine infections (broad spectrum synergistic activity). Antibiotics have been shown to have a detrimental effect on the sperm cell. They caused a decrease in sperm motility. The average value calculated on all ATBs was 18% (the initial motility of the control group was 78%) and an alteration of the linear speed which would have a negative impact on fertilization. On the other hand, symbiotics had a beneficial effect on spermatozoa motility and vitality. Symbiotic and colistin combination was very promising. In conclusion, the use of symbiotics in the treatment of SCE at the time of goat AI is beneficial and it has to be proven by more investigations in the future.

Keywords: *sperm, antibiotic, symbiotic, CASA, semen.*

REPRODUCTIVE PARAMETERS IN A DAIRY FARM IN THE CENTER REGION OF ALGERIA

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Abstract

The objectives of the present study were to evaluate the reproductive parameters of 200 Holstein dairy cows, to study some factors that may influence these parameters and to characterize the metabolic profile of repeat breeder cows (RBC). The experiment was carried out on a private farm located in the North of Algeria. Fertility was estimated for each cow by calculating the parameters: Calving-First service interval (CFSI), calving-conception interval (CCI), calving-calving interval (CI), first service - conception rate (FSCR) and fertility index (FI). Parity, dairy production and BCS were used as covariate to determine their effect on CCI and FSCR dependent variables. Blood serum parameters such as glucose, total protein, triglycerides, cholesterol, urea and B-hydroxybutyrate were assayed by spectrophotometry. Insulin and progesterone serum levels were detected by immunological tests. There was a high CS1 interval. Also, 44% of animals had a prolonged CCI (>110 days) and the FSCR was estimated at 42%, below the recommended values (>60%). RBC were noted in 35% of the total, higher than the intended standard (< 15%). FSCR and CCI were significantly influenced by parity and BCS ($P < 0.001$). No significant milk yield effect on FSCR were reported ($P > 0.05$) but CCI was significantly related to this parameter ($P < 0.001$). RBC were characterized by low levels of insulin and high urea concentrations compared to fertile females ($P < 0.001$). In the conclusion, the reproduction parameters obtained in this study were very far from the standard objectives recommended for effective management of reproduction. It can be due to bad heat detections or/and undernutrition. These parameters were influenced by parity, BCS and milk production. Concentrations of insulin and urea can have some effects on reproductive problems such as repeat breeding and they help to understand potential mechanisms impairing fertility in RBC.

Key words: *Algeria, dairy cow, Holstein, infertility, insulin, urea.*

FELINE LEISHMANIASIS IN ALGERIA

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Abstract

Feline Leishmaniasis (FL) is a relatively rare feature, the clinical disease has been described in cats since the 1990s, with most reports focusing on infected cats living in endemic areas. When typing of the causative agent has been performed, L. Infantum has been identified in all reported cases. A spot study was carried out at the pound (HURBAL) of Algiers. Blood samples were taken from a sample of fifty (50) cats and fifty (50) stray dogs (the latter being considered as the main reservoirs of the disease). These samples were tested by three (3) methods (FLG, Witness and IFI) in order to determine the prevalence of Leishmaniasis in each species. The objective of this work was to compare the results obtained in these two (2) species subjected to the same infectious risk since they are stray animals collected in the same region, namely the region of Algiers which includes 57 communes. The results collected were processed by the Excel 2007 software and showed prevalence of 40% and 36% in dogs and cats respectively. In a second phase, statistical studies were carried out in order to better define the pathology in cats, a species considered as an accessory reservoir for many international studies, but of which we know practically nothing in Algeria. The calculation of positive predictive value (PPV) and negative predictive value (NPV) gave the following result: PPV= 83.33%; NPV= 94.11. The results obtained using Statistica 7.0 software by comparing variables such as age, lesions, race and sex showed no significant difference ($P > 0.05$) apart from those found by comparing lesions and sex in the 2 species ($P \leq 0.05$).

Keywords: *Leishmaniasis, Cat, -Prevalence, Witness, Algeria.*

PREVALENCE OF THE MAIN REASONS FOR SEIZING CARCASSES AND BOVINE VISCERS IN SLAUGHTERHOUSES IN NORTHERN ALGERIA

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Abstract

The consumption of bovine meat is very important in Algeria. As a result, the slaughter of cattle intended for consumption is regulated and subject to rigorous sanitary inspection at slaughterhouse level by veterinary inspectors. Our study was carried out at two slaughterhouses located in northern Algeria during the period from September to December 2012, in order to highlight the prevalence of the main reasons for the seizure of carcasses and viscera in slaughtered cattle. Our results showed that out of the 300 cattle intended for slaughter, 71 were declared sick after ante-mortem examination (23.66%) due to various causes mainly: Hydatidosis (30.9%), pulmonary tuberculosis chronic as well as bronchopneumonia (29.6%), traumatic reticuloperitonitis RPT (14.1%), fascioliasis (8.5%) and fractures (8.5%). Post-mortem examination of the carcasses and viscera of diseased cattle revealed the presence of various lesions in 61 of the cases (85.9%). These hydatidosis, tuberculosis, fascioliasis and pneumopathy lesions were responsible for cases of partial (50.8%), total (34.4%) and trimming (14.8%) seizures. Compared to the organ seized, the lung (45.9%) comes in first position followed by the liver (19.7%), heart (9.8%), stomach (9.8%), limbs (9, 8%) and kidneys (4.9%). Our results show that the lung and liver remain the most affected organs. This work has enabled us to highlight the main lesions affecting cattle intended for consumption, to suggest avenues for improving sanitary inspection in slaughterhouses for better control of animal health.

Keywords: *Prevalence, lesions, carcass and viscera, cattle, Algeria.*

STUDY OF CERTAIN ZOOTECHNICAL PARAMETERS DURING MONITORING OF CHICKEN BREEDING IN ALGERIA

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Abstract

Obtaining good zootechnical performance in broiler rearing requires continuous and regular monitoring throughout the rearing period for better rearing profitability. The objective of this work is to compare the zootechnical performance of a broiler farm "classic ISA strain" against the standard of the latter. Our study was carried out in the department of AIN DEFLA (northern Algeria) for a period of 46 days and it consisted of monitoring a broiler farm composed of 2,100 one-day chicks (classic ISA strain). The results obtained were quite close to the norm for the consumption index (CI = 2.24). On the other hand, we reported a fairly high mortality rate equal to 7% and an average daily gain of around 34,69%, value below standard. At autopsy of the dead subjects, we noted the presence of lesions characterizing the presence of an episode of coccidiosis and chronic respiratory diseases in the farm followed, as well as the presence of some bone and joint malformations. The technical results obtained were satisfactory compared to those of the classic ISA strain, despite the non-compliance with the hygiene standards observed. However, the onset of coccidiosis in the 40th day caused a moderately high death rate which was compensated by the rapid initiation of anticoccidial therapy. The most effective means against economic losses remains the good respect of the standards of the behavior of poultry farming.

Keywords: *Farm monitoring, Broiler, Zootechnical performance, Algeria.*

PREVALENCE AND RISK FACTORS OF CRYPTOSPORIDIOSIS IN CALVES IN NORTHERN ALGERIA

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Abstract

Cryptosporidiosis is a cosmopolitan opportunistic zoonosis caused by various species belonging to the genus Cryptosporidium. The aim of our study is to determine the dynamics (kinetics) of Cryptosporidium sp in four dairy cattle farms located in northern Algeria. Our longitudinal study was carried out on 80 calves from which 1066 faecal samples were taken. Macroscopic examination revealed a non-diarrheal nature in 64.3% ($p < 0.001$) of the samples taken with a predominance of the yellow-straw color (48.50%). In our study, the parasitic infestation by Cryptosporidium sp starts around the 3rd day and decreases around the 45^{th} postnatal day ($p < 0.001$). The statistical analysis revealed several risk factors associated with a high risk of exposure to Cryptosporidium sp and concern: the female sex (54.29%; $p < 0.05$), the spring season ($p < 0.001$) and the straw yellow color of faeces ($p < 0.001$). The present study made it possible to determine the prevalence of cryptosporidiosis in calves by the modified Ziehl Nielson technique in dairy farms in northern Algeria. This characterization and the identification of the factors associated with an increased risk of exposure constitute an interesting first step in the implementation of recommendations aimed at reducing the frequency of cryptosporidiosis. This study should be continued by carrying out epidemiological surveys on a larger scale associated with the more specific identification by more advanced techniques such as PCR of the parasite involved.

Keywords: *Neonatal diarrhea, calf, Cryptosporidium sp, Modified Ziehl Nielson stain, risk factors, North Algeria.*

STUDY OF ANOGENITAL DISTANCE IN RABBITS: EFFECT ON SEXUAL BEHAVIOUR AND LITTER SIZE BIOLOGIC COMPONENTS

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Abstract

The aim of this paper is to study the relationship between the anogenital distance (AGD) measured before mating, plasma cholesterol and hormones concentrations (testosterone and 17-βestradiol), sexual behavior, litter size and its components, and the sex ratio in rabbits. In total, 48 rabbit does were used. The females were classified according to their AGD on 2 groups (AGD large or AGDL, n = 24 and AGD short or AGDS, n = 24). Blood samples were collected before mating, receptivity of the females was tested and their behavior was observed. Endoscopy was performed at d12 of pregnancy. The number of total born, alive, dead and the sex ratio were recorded at birth. The plasma testosterone and cholesterol concentrations were significantly higher in AGDL group of females (+ 14 and + 24% respectively). The AGDL females presented higher rate of receptivity (+31%; $P<0.05$), they were more aggressive (+78%; $P<0.05$) and marked more frequently their territory using the spontaneous chin marking than AGDS females (+34%; $P<0.05$). The number of implanted embryos was significantly higher in AGDS group (9.12 vs. 8.66 embryos). The embryonic, fetal and prenatal survival were significantly higher in AGDS females. In addition, the AGDS females presented higher litter size at birth (8.96 vs. 7.83; $P<0.01$) and sex ratio based male (61.6 vs. 41 %; $P<0.01$). In conclusion, the AGD measured before mating can be used as predictor of the hormonal statute, sexual behavior, litter size at birth and the sex ratio in rabbits.

Key words: *AGD, hormones, morphology, prolificacy, rabbit, receptivity*.

SEROPREVALENCE OF BORDER DISEASE VIRUS AND OTHER PESTIVIRUSES IN SHEEP IN ALGERIA AND ASSOCIATED RISK FACTORS

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Abstract

Border disease virus (BDV) is a pestivirus responsible for significant economic losses in sheep industry. The present study was conducted between 2015 and 2016 to determine the flock seroprevalence of the disease in Algeria and to identify associated risk factors. Fifty six (56) flocks from nine departments were visited and 689 blood samples were collected from adult sheep between 6 and 24 months of age (n = 576) and from lambs younger than 6 months (n = 113). All samples were tested by RT-PCR as well as by Ag-ELISA, to detect Persistently Infected (PI) animals. Serum samples from adults were tested by Ab-ELISA (Enzyme Linked Immuno-Sorbent Assay), to detect specific antibodies against pestivirus and 197 of them were further characterized by VNT (virus neutralization test) for the detection of neutralizing antibodies specific for BDV and for Bovine virus diarrhea virus (BVDV-1 and BVDV-2). No PI animals were found among the 689 sheep tested. 144/197 sera were positive in VNT for BDV, and 2 sera were strongly positive BVDV-2. Fifty-five flocks (98%) had at least one seropositive animal and the apparent within-flock seroprevalence was estimated to be 60.17% (95% C.I.: 52.96–66.96). The true seroprevalence based on estimated sensitivity and specificity of the Ab-ELISA was 68.20% (95% C.I.; 60.2–76.3). Several risk factors were identified as linked to BDV such as climate, landscape, flock management and presence of other ruminant species in the farm. These high seroprevalence rates suggest that BDV is widespread and is probably endemic all over the country. Further studies are needed to detect and isolate the virus strains circulating in the country and understand the distribution and impact of pestiviruses in the Algerian livestock.

Keywords: *Border disease virus, Pestivirus, Seroprevalence, Sheep, Algeria, Persistently infected.*

CONTRIBUTION TO THE ASSESSMENT OF THE PHYSICOCHEMICAL, MICROBIOLOGICAL AND PARASITOLOGICAL QUALITY OF WATER FOR LIVESTOCK IN THE CENTRAL ALGER REGION

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Abstract

For a better sanitary management of the dairy farms, an analysis of the water quality seems important. This one can be an important source of bacteria, virus or even parasites. The objective of this work was to study the physicochemical, bacteriological and parasitological quality of the drinking water intended for dairy cattle farming. A total of 18 water samples were taken from 9 farms in the central Alger region (2 samples per farm). The first sample was intended to assess the overall physico-chemical and microbiological quality based on ten parameters: conductivity, dissolved oxygen, turbidity, ammonium, nitrites, nitrates, o-phosphates, total coliforms, fecal coliforms and fecal streptococci. The second sample for parasitological examination, on the other hand, was quickly centrifuged and the pellet was recovered and examined (direct examination then Ziehl-Neelsen staining in order to search for cryptosporidia). The physicochemical and bacteriological quality was average to poor for the majority of the farms controlled with a majority contamination by faecal Streptococci. Parasitological examination revealed the presence of *Cryptosporiduim spp* in some farms, largely explaining the neonatal diarrhea observed in newborn calves. In conclusion, the water of the majority of the controlled farms is substandard and requires disinfection with bleach or porous brick.

Keywords: *water, dairy cattle, quality, central Algiers.*

CHARACTERIZATION OF SEMEN OF THREE RABBIT BREEDS AND ARTIFICIAL INSEMINATION

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Abstract

This work aims to study the quantitative and qualitative characteristics of the semen of three rabbit breeds, and to compare zootechnical growth performances related to reproduction in females conducted by natural mating (NM) or artificial insemination (AI). Thirty males aged 5-6 months were divided into 3 groups of 10 each (local population, Californian, hybrid). Throughout the experiment, two successive ejaculates were collected twice a week during 6 weeks. Furthermore, 20 nulliparous rabbits were divided into two groups of 10 each (one group of females were artificially inseminated (AI) and the other group of females conducted in natural mating (NM)). No significant differences were noted between 3 male groups for the average ejaculate volume (1.11 ± 0.43; $p>0.05$), pH (7.16 ± 0.18) and individual motility (2.36 ± 0.4; $p>0.05$). However, bucks of the local population showed significantly higher massale motility compared to that recorded in hybrid rabbits (+ 30%; $p<0.05$) on one hand, and Californian rabbits on the other hand (+ 27%, $p<0.05$). The average concentration of semen on spermatozoids per ejaculate was comparable between hybrids and Californian rabbits, but significantly lower in local rabbits (-30%, $p<0.05$). The fertility rate was 76.92% against 53.84% in NM and AI, respectively. The total number of kits newborn was higher in NM compared to AI (6.5 ± 1.25 *vs*. 5.42 ± 1.90, a difference of 16%). However, the difference recorded was not significant ($p>0.05$). It should be noted that the stillbirth rate was equal in both groups of females. The number of weaned rabbits by weaning and mortality between birth and weaning were 4.6 ± 1.50 and 38.80% and 4 ± 1.2 and 35.71% in NM and IA, respectively. The use of artificial insemination in Algeria for the first time has given very encouraging results. However, further works on more effective and more advanced parities seem necessary.

Keywords: *rabbit, semen, fertility, biotechnology.*

GENETIC CORRELATIONS FOR REPRODUCTIVE AND GROWTH TRAITS IN RABBITS

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Abstract

In Algeria, in order to develop meat rabbit production, a new rabbit line was created by cross breeding between the local population and the INRA2666 line in 2003. This line has presented higher litter size (29%) and a good adaptation to heat stress conditions. Genetic parameters for reproductive (litter size at birth, number of born alive and litter size at weaning), growth traits (individual weaning weight and individual weight at the end of the fattening period) and the genetic correlations were estimated. A total of 805 females, 3,242 parities and 18,472 growth records were measured from 2006 to 2017. A penta-variate animal model was used with reproductive and growth traits. Heritability ranged from 0.025 to 0.126 for reproductive traits and from 0.033 to 0.059 for growth traits. The repeatability of reproductive traits was low and the common litter effect for growth traits was the most important component of total variance. The genetic and phenotypic correlations between reproductive and growth parameters were high and negative, especially with weight at weaning (-0.848, -0.922 and -0.854 for litter size at birth, number of born alive and litter size at weaning, respectively). In conclusion, both reproductive and growth traits should be selected in independent lines and the response to selection should be mainlydue to the high coefficient of variation of the traits.

Key words: *genetic correlation, heritability, litter size, weaning weight, rabbits.*

EVALUATION OF DIGESTIVE DISORDERS DUE TO *ESCHERICHIA COLI* IN RABBIT FARMS IN ALGERIA

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Abstract

The study of pathologies affecting our farms contributes, without doubt, to the improvement of our production and thus its economic impact. However, research on rabbit breeding pathologies in Algeria is limited.m This study aims to evaluate the involvement of digestive diseases caused by *Escherichia coli* in our farms in the Wilaya of Blida. First time, our survey reported a rate of 90.48% for the diarrhea syndrome in our farms. In a second step, the percentage of diarrhea followed by three farms varied between 14 and 17% for a sample of 97 rabbits and the number of fatalities was 23.04% for a total of 230 weaned rabbits. On bacteriological examination, 180 faecal samples from the three farms using respectively in the drinking water: building a disinfectant, vinegar and an anti-stress showed different colibacillaires counts. The values of the four week follow-up to the first site, showed an insignificant difference ($P > 0.05$), vs. those of the second and third with a very highly significant difference ($P < 0.001$). In a final step, 10% of a total of 50 strains of *E. coli* showed resistance to Ampicillin vs 90% with intermediate resistance.96% of strains were sensitive to gentamicin and 92% of the strains were sensitive to amoxicillin vs 2% resistant to it.

Keywords: *Escherichia coli, rabbit, weaning, digestive disorders.*

PERINATAL FACTORS AFFECTING SURVIVAL OF KITS

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Abstract

In Algeria, a synthetic strain of rabbit (ITELV2006) has been created since 2003 by crossing the rabbits of the local population with the strain INRA 2666 (France), in the Technical Institute of Breeding of Algiers. The objective of this study was to examine the effect of parity order, season, lactation status, quality of nest, sex, kindling on cage, cannibalism, and weight of kit at birth on its survival in the early hours after delivery. A total of 1696 kits from77 females of ITELV2006 Synthetic line were used in this study. Kindling on cage effect and kit weight at birth were significant ($p<0.001$), as well as cannibalism having a significant effect on the survival of kits ($p\leq 0.05$). However, lactation, sex ($p=0.10$), parity, season, and nest quality ($p>0.10$) had no effect on survival of kits. When weight at birth was 45 g, survival probability was 90% and only 60% if they were born outside the nest. Cannibalism also reduced survival from 25 to 10% in kits with weights between 15 and 75 g. In conclusion, a high weight of kit at birth increases its survival in unfavourable conditions of maternal behaviour.

Key words: *cannibalism, birth weight, kindling on cage, rabbit, survival.*

PREVALENCE OF COCCIDIAN INFECTION IN RABBIT FARMS IN NORTH ALGERIA

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Abstract

The aim of the present study was to determine the prevalence and intensity of rabbit coccidiosis (*Oryctolagus cuniculus*) in North Algeria. Fourty (40) rabbit farms were investigated. The farms are located in the provinces of Tizi Ouzou, Médéa, and Djelfadistributed, respectively, into three regions: East Tell Atlas Mountains, Central Tell Atlas Mountains, and High Plateaus. The number of oocyst per gram of feces (OPG) was determined by McMaster technique, and the Eimeria species were identified using morphological criteria. In the farms investigated, the prevalence of coccidian infection was estimated to 90% (80.7-99.3%) in rabbits after weaning. The classification of the farms according to their parasite load allowed us to show that 37.5% of the prospective farms had an oocyst excretion between 104 and 5×104 oocysts per gram and 22.5% excrete >5×104 oocysts per gram. Excretion levels by region show that the region of East Tel Atlas Mountains ranks first with 79% of farms with a parasitic load >104 coccidians compared to the regions of Central Tel Atlas Mountains and High Plateaus. In total, eight species of Eimeria were identified from oocyst-positive samples. Mixed infections with four Eimeria species were common. *E. magna* is the dominant species in comparison with *E. media* and *E. irresidua* with respective frequencies of 42.5% and 17.6% and 14.9% ($p<0.001$). Our results showed that the farms using anticoccidial drugs for their rabbits were low (25%) and the percentage of farms with poor hygienic conditions was 65%. There was a significant association between increased oocysts excretion and control measures of coccidian infection. The study revealed an overall prevalence of 90% in the three Algerian regions. A strong association was observed between Eimeria infection and hygienic status and preventive chemotherapy.

Keywords: *Algeria, coccidiosis, Eimeria, oocysts, prevalence, rabbit.*

IMPACT OF COCCIDIAL INFECTION ON THE ZOOTECHNICAL PERFORMANCE OF THE LOCAL RABBITS POPULATION

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Abstract

The aim of this work was to study the experimental infection of local rabbits with two species of coccidia, *Eimeria magna* and *Eimeria media* at doses of 5×104 and 105 oocysts, having caused parasitic excretion without affecting the growth of the animals. Food consumption was significantly reduced in the most infested rabbits ($p<0.05$). On the 7th day post-infection, 2 rabbits from the inoculated groups presented with mild diarrhea that disappeared in 2 days. In addition, no mortality was recorded in the different groups.

Key words: *coccidiosis, Eimeria sp., experimental infection, local rabbit.*

EFFECT OF INCORPORATION OF THE PLANT EXTRACTS IN NATURAL CASING ON CONTENT OF FATTY ACIDS IN FERMENTED SAUSAGES

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Abstract

In this study, the effect of natural casing treated with ethanol extract of *Aronia melanocarpa* and *Cornus mas* on the fatty acid content in fermented sausages "sucuk" type was evaluated. The sausages were produced in industrial conditions, stuffed into the pretreated natural casings, vacuum packaged, and stored at 4°C for six months. Five groups of sausages were tested, C1 (natural casing without treatment), C2 (treated with 6% (v/v) ethanol), C3 (treated with ascorbic acid), A (treated with ethanol extract of *A. melanocarpa*), and D (treated with ethanol extract of *C. mas*). The qualitative and quantitative composition of fatty acids in the tested samples was determined by the GC-FID analytical technique. Palmitic (C16:0) and stearic (C18:0) acids were predominant of the saturated fatty acids (SFA) and their quantity ranged from 15.93% to 27.50%, and 13.81% to 24.74%, respectively. Oleic acid (C18:1) in the range from 19.02% to 31.87% was the most represented unsaturated fatty acid (USFA). Based on the obtained results, it can be concluded that treated casings had a statistically significant effect ($p<0.05$) on the content of the identified fatty acids in tested samples. During six months of storage, it was noticed a decrease in SFA content and an increase in USFA content, especially C22:1, C24:1, and C22:6. The ratio SFA/USFA ranged from 1.04% to 1.50% after production and from 0.53% to 0.69% after six months of storage. The ratio of polyunsaturated fatty acids (PUFA) n-6/n-3 ranged from 0.27% to 5.14% after production and from 0.23% to 1.65% at the end of the testing period.

Keywords: *fermented sausage, extract, natural casing, fatty acids.*

EFFECT OF THAWING METHODS ON THE PHYSICO-CHEMICAL PROPERTIES OF TURKEY MEAT

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Abstract

Freezing meat, as a method of canning, aims to maximize the storage period, while preserving the quality and nutritional value of the product after thawing. The aim of this paper was to examine the effect of thawing methods on the physico-chemical properties of turkey meat. Freezing of the meat samples was performed at a temperature of -20ºC. Prior to analysis, the samples were thawed in one of the following ways: 10 hours at 4°C (in a refrigerator), 2 hours at 20°C (at room temperature) and in a microwave oven (2450 MHz, 700 W), until a temperature of 4°C in the center of a meat piece. The following analyzes were performed: determination of weight loss, determination of moisture, ash, fats and proteins content, measurement of water binding capacity, instrumental measurement of color and texture, measurement of a_w value and pH value. Based on the results obtained in this paper, it can be concluded that thawing methods have a statistically significant effect ($p<0.05$) on the physico-chemical properties of turkey meat. The samples of turkey meat thawed in the refrigerator had the lowest weight loss (1.79%), the highest water content (75.34%) and the highest water binding capacity (2.65 cm^2), compared to the samples thawed in the microwave and at room temperature. It can be concluded that by slow thawing of turkey meat (at the refrigerator temperature), water has enough time to rebind to proteins, and in that case there will be less separated liquids.

Keywords: *Turkey meat, Thawing, Physico-chemical properties.*

SENSORY PROPERTIES OF CHEESES OBTAINED BY DIFFERENT PROCESSES HEAT-ACID COAGULATION OF MILK

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Abstract

The sensory properties of food product have an influence on overall quality and consumers' product acceptance. Different factors during processing have an impact on quality characteristics of the final product. As a very important foodstuff in human nutrition, cheese can be produced in different ways and have different composition and sensory properties. The aim of this study was to examine the influence of coagulation conditions (type of coagulant and coagulation temperature) on the sensory properties of six produced cheese samples. Milk coagulation was performed at 85°C (samples 1,3,5) and 95°C (samples 2,4,6), and citric acid (samples 1 and 2), tartaric acid (samples 3 and 4) and acetic acid (samples 5 and 6)were used as coagulants. A team of 10 trained evaluators has performed sensory analysis of tested cheese samples by ranking samples according to acceptability and using a 5-point scoring system (1=very considerable deviation from expected quality to 5=no deviation from expected quality) to assess appearance (external and cross-sectional), odour, flavour and consistency. Based on the obtained results, it can be concluded that coagulation conditions have a statistically significant effect ($p<0.05$) on the appearance, flavour and consistency of produced cheeses. Sample five had the highest score (5.00) for external appearance, and the cross-sectional appearance was the best in sample four (score 4.80). The odour of all samples was excellent (score 5.00), while the samples five and six had slightly lower scores for flavour and consistency. Sample four was most acceptable by ranking according to overall acceptability.

Keywords: *Milk, cheese, sensory properties.*

NUTRITIONAL VALUE OF TRAPPIST CHEESE

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Abstract

The objective of this paper is to present research findings, obtained for nutritional values of Trappist cheese, produced by the monks of the Banja Luka "Maria Zvijezda" monastery, in cooperation with Agricultural Cooperative Livac. Cheese is an important food and is a part of people's daily nutrition. New trends that are promoting a balanced diet are also setting new requirements for the familiarity with nutritional value of cheeses. Until now there has been no opportunity to analyse nutritional value of Trappist cheese due to the specificity of its production. Some analyses might have existed, but the library was destroyed back in 1945, and possibly written traces if there had been any. Some of the characteristics of Trappist cheese are that it is in the shape of a ring, it weighs between 1,6 kg and 2.0 kg, and it has a natural rind, which is yellowish, thin and smooth. The conditions for its ripening and the manner of its ripening are specific and they give this cheese a special aroma. The ripening period is minimum 90 days, under specific air humidity and temperature conditions. The cheese matures on wooden shelves, being regularly turned around and wiped by hand. The consistency of cheese body is soft, elastic, tender and it is easy to cut. The cut is smooth, without or with just a few holes, while the colour of cheese body is yellowish. It is characterized by clean, milk-specific aroma, and is moderately salty with quite meltable texture. The milk fat content is 34,5 grams, saturated fatty acids 24,7 grams, carbohydrates 0.8 grams, proteins 27.5 grams and the content of NaCl amounts to 2,05 g/100 grams of cheese. The energy value of Trappist cheese is 424 kcal or 1758 kJ, Water content is 41.6 g/100 grams, while the dry matter amounts to 56,8 g/100 g,

Key words: *nutritional values, monastery Maria Zvijezda, cheese Trappist.*

A CONTROL SYSTEM FOR REMOTE MONITORING AND CONTROL OF THE TEMPERATURE IN CHICKEN EGGS HATCHING USING ARTIFICIAL INCUBATORS

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Abstract

According to OACD/FAO Agricultural Outlook, poultry meat remains the primary driver of growth in total meat production. Its short production cycle allows producers to respond quickly to market needs, as well as rapid improvements in genetics, animal health, feeding practices, breeding conditions and breeding environment. Hatching process needs to be done properly in order to maximize the number of healthy chickens hatched and to minimize their death rate. When using artificial egg incubation, it is important to monitor and control ambient conditions in incubators, to obtain ventilation and egg turning. Ambient conditions are expressed in terms of temperature and humidity, where maintaining and controlling the temperature inside the incubator is of the greatest importance. This paper deals with the description of a control system developed for remote monitoring and control of the temperature in chicken eggs hatching using artificial incubators. The system consists of heater in a form of an incandescent light bulb, temperature sensor, relay, microcontroller, and communication module. For temperature control, a PID (proportional-integral-derivative) controller is designed, which maintains the temperature at 37.8 °C. Temperature readings are available through the web browser and are accessible using wired Internet connection. Proposed system represents a simple, low-cost but very efficient solution which provides the necessary conditions for proper development of chickens while growing inside the egg.

Key words: *temperature control, PID, hatching, artificial incubator, Internet of Things.*

INFLUENCE OF THE AGE OF LAYING HENS ON EGG PRODUCTION INTENSITY OF DIFFERENT EGG WEIGHT GROUPS

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Abstract

The aim of this paper is to examine the egg production of commercial flock of light line hybrids Lohmann Brown, as well as the influence of laying hen age on egg production intensity of different egg weight groups, housed in conventional cage system. The examinations were performed in the production conditions on the farm "Agrovet" in Foca, Bosnia and Herzegovina. Since it is established that commercial flocks in egg production are kept until the end of 72nd week of age (WA) as the final instance in production, the aim of this paper is to examine what happens to production performance, ie laying intensity, after the established 72nd week of laying hen age. In this paper, it is the period of seven weeks, until the 79th week of age of the laying hen of the Lohmann Brown hybrid, where the production period lasted for 61 weeks, ie 427 days. Based on the results of examination, it was concluded that egg production, as well as laying intensity gradually increase to 27th week of age, when the maximum laying intensity was reached, followed by gradual decline in egg production until the end of the flock exploitation period, with occasional variations. Analized by the weight groups, during 61 weeks of production, the class M was the most represented with a laying intensity of 47.47%, followed by the class L (31.64%), class XL (3.12%) and then class S with 1.79%. A positive coefficient of phenotypic correlation was determined between the age of laying hen and laying intensity in all egg weight groups. It was statistically very highly significant ($p<0.001$) until 36th week of age, highly significant between 36th and 42nd week of age ($p<0.01$), and significant from 42nd to 52nd week of age ($p<0.05$).

Key words: *Lohmann Brown, Age, Egg production intensity, Egg weight groups.*

INFLUENCE OF LOCATION ON PARAMETERS OF CORN SILAGE QUALITY PREPARED ON FAMILY FARMS

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Abstract

The testing of quality parameters, energy value and length of corn silage cuttings was conducted on 108 farms and 7 localities in the lowland area of Republic of Srpska. These tests include family farms at six locations. The aim of these tests is to determine the impact of localities, i.e. agroecological and geographical conditions on the quality parameters and energy value of corn silage prepared on family farms in the lowland part of Srpska, where livestock production is most intensive. Analysis of silage samples was performed using an AgriNir analyzer. Silage samples were analyzed on many parameters, of which several were processed in this paper, and that are: pH value, dry matter content and crude protein content. The net energy of lactation (NEL) was calculated for each tested silage. Using a Penn State Particle Separator, silage samples were separated according to the length of cuttings into 4 fractions. According to the pH value, silages of excellent quality are those with a range of 3.8-4.0. According to our tests the lowest average pH value had silage in the area of Laktaši, and it amounted to 3.61. Silages prepared on family farms at the following locations: Gradiška, Srbac, Kozarska Dubica and Derventa also had lower average pH values. Silage prepared at the locations of Prnjavor and Bijeljina had optimal pH values. The dry matter content at all locations was optimal and ranged from 298.5 g kg^{-1} (Bijeljina) to 344.75 g kg^{-1} (Gradiška). The crude protein content of silage varied from 69.0 g kg^{-1} to 84.35 g kg^{-1}. The average NEL value was 5.71–5.94 MJ kg^{-1} DM. The length of silage cuttings at most locations is not within the optimal values for individual fractions. Highly significant deviations in the length of silage cuttings mass were found on the middle sieve (8-19 mm) and box (below 4 mm) at the locations of Laktaši, Gradiška, Srbac and Kozarska Dubica.

Keywords: *silage, location, pH, crude proteins, NEL.*

TECHNICAL EFFICIENCY OF THE RIPARIAN BEEKEEPERS OF THE COMPLEX OF PROTECTED AREAS PÔ-NAZINGA-SISSILI IN BURKINA FASO

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Abstract

This paper presents the results of an analysis of the determinants of the technical efficiency of beekeepers in villages impacted by the creation of elephant corridor called Corridor No. 1 of the Pô-Nazinga-Sissili protected area complex in southern Burkina Faso. The socioeconomic data used in this analysis were collected on a sample of 52 beekeepers in July and August 2018. A Cobb-Douglas type honey production function with inefficiency effects was estimated for this purpose. The results showed that 75% of the discrepancy between potential and actual honey quantity would be due to beekeepers' technical inefficiency and that the average score of beekeepers' inefficiency effects was 0.78. It should be noted that the location of the hives, the number of years of beekeeping training received and the possession of a beekeeping suit are the significant variables that increase the efficiency level of the beekeepers. On the other hand, belonging to a beekeeping association has a negative effect on honey production. The results highlight that locating hives within one kilometer of the elephant corridor significantly improves the technical efficiency and production of beekeepers. However, the survival of these pachyderms is threatened because of human reprisals against them following their possible overflow into the riparian villages. Thus, an effective and sustainable policy aiming at both the conservation of the forest and an improvement of the incomes of the riparian households can be implemented by a location of the hives next to the forest.

Keywords: *Beekeeping, technical efficiency, protected areas, Burkina Faso.*

VALIDATION OF A SCREENING METHOD FOR THE DETECTION OF RESIDUES OF SIX FAMILIES OF ANTIBIOTICS IN BROILER CHICKEN DROPPINGS

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Abstract

Antibiotic residues (AR) are of great importance in food production, due to the consequences for human health, such as the development of antimicrobial resistance. A large percentage of these drugs have been described to be excreted in animal waste, since they are not completely metabolized, varying between 90-30%. The detection of AR in manure could be used as a non-invasive sampling method and thus a tool for monitoring the use of AR in animal production. We proposed to implement and validate a new screening methodology for the detection of 6 antibiotic families in manure. The validation process was performed by evaluating the parameters following the recommendations of the Commission Decision 2002/657/EC. CCβ (β = 5%) was measured using 20 blank samples fortified at 200 µg/kg obtaining the following results: tetracyclines 103 µg/kg, beta-lactams 104 µg/kg, macrolides 103 µg/kg, quinolones 402 µg/kg, sulfonamides 203 µg/kg and lincosamides 203 µg/kg. Specificity was determined by analyzing 20 fortified samples at 200 µg/kg, by two independent experiments. Method was specific to detect all studied antibiotics, except tetracyclines. Robustness analysis showed that the method was sufficiently robust against 3 selected factors for all the antibiotic families, except beta-lactams where the method was not robust when the factors varied in different magnitudes. Applicabilitywas carried out analyzing bovine and swine feces, defining that the method was applicable in feces of other productive species. In conclusion, the implemented analytical methodology presented performance characteristics that demonstrate the usefulness for the intended analytical applications, ensuring the trace ability of the results according to common internationally recognized standards.

Key words: *antibiotics, chicken.*

Acknowledgments: ANID/ FONDEF/ID19I10033.

EFFECT OF THE EXTRACTION PROCESS OVER THE OXYGEN RADICAL ABSORBANCE CAPACITY (ORAC) AND POLYPHENOL PROFILES OF GRAPE MARC

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Abstract

The salmon industry is consistently reducing the use of marine ingredients replacing with various alternatives among them terrestrial plant sources. This strategy has been adapted worldwide successfully replacing near half of fishmeal is, however higher levels of inclusion of plant protein, particularly soybean meal, are still associated with reductions on fish performance associated with alterations in the antioxidant defenses in different fish tissues. Studies in mammals, and evidence from our lab in fish have shown that the intake of plant phenolic compounds have beneficial antioxidant properties can improve fish productive performance, in particular feed conversion. The use of agriculture by-products like those derived from the wine industry have great potential to be used in "circular nutrition": how ever due to the characteristics of these type of products in its raw form, the generation of concentrated extracts is a necessity in order to be used particularly in carnivorous fish diets. Hence our objective was to characterize different extraction strategies to generate a grape extract to be included in fish diets We used red wine grape pomace as raw material and evaluated different extraction conditions using phenolic compounds contents and HPLC-DAD chromatographic profiles of anthocyanic and non-anthocyanic low molecular phenolics along with ORAC to define the best extraction strategy. Initial data indicates that the total polyphenols purity from the different extraction use are higher than 20%

Key words: *grape marc, nutrition, fish diet.*

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ACARICIDAL EFFECT OF ESSENTIAL OILS ACTIVE SUBSTANCES AND ACTIVE SUBSTANCES OF ACARICIDES AGAINST THE POULTRY RED MITES

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Abstract

The aim was to compare acaricidal effect of selected active substances of essential oils and active substances of commercially used acaricides against the poultry red mites (*Dermanyssus gallinae*, PRM). Adults PRM were collected from farms with cages system of egg-laying hens in the Czech Republic in 2020. Acaricidal effect of ten active substances of essential oils (eugenol, linalool, cinnamaldehyde, limonene, eucalyptol, menthol, (E)-anethol, thymol, carvacrol, citral) and four active substances of commercially used acaricides (cypermethrin, spinosad, KAS - CAS 85409-23-0, EC 287-090-7 and CAS 68391-01-5, EC 269-919-4; phoxim) was evaluated by method no. 11 from IRAC (Insecticide Resistance Action Committee) susceptibility test methods series. This is in vitro direct contact method. Commercial acaricides were used according to recommended field application rates. The assessment of acaricidal effect was scored after 24 hours after the treatment. The average mortality in negative control was 6.6%. The highest PRM mortality was observed with menthol, (E)-anethol, thymol, carvacrol, citral and from acaricides: phoxim and KAS - CAS 85409-23-0, EC 287-090-7 and CAS 68391-01-5, EC 269-919-4. In general, acaricidal effect of selected active substances of essential oils was stronger than active substances of commercially used acaricides. Selected active substances of essential oils could be further tested and developed as potential natural botanical acaricides against PRM.

Keywords: *Dermanyssus gallinae, active substances, botanical acaricide, natural pesticide.*

EFFECT OF PRE-INCUBATION ON EMBRYONIC DEVELOPMENT AND HATCHABILITY

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Abstract

The effect of preincubation and length of egg storage on hatchability and stage of embryonic development were examined in present study. The experiment was conducted using Ross 308 hatching eggs that had been stored for 10 days before placement to setter, broiler breeder´s age was 38 weeks. Totally 3600 hatching eggs were used in 60 repetitions. On the 5th day of storage experimental interventions were performed. The treatment groups were as follows: R0 without pre-incubation, R1 pre-incubation at 95°F for 1 hour, R2 pre-incubation at 95°F for 2 hours, R3 pre-incubation at 95°F for 3 hours, R4 pre-incubation at 95°F for 4 hours, and R5 pre-incubation at 95°F for 5 hours. Fertility, hatchability percentage from the total incubated eggs and from fertile eggs, weekly embryonic mortality, day-old chick weight, weight of egg and yolk and stage of embryonic development were detected. There was not statistically significant difference ($P>0.05$) in fertility between the observed groups. The hatchability of set eggs, as well as the hatchability from fertile eggs were highest in group R0 ($P<0.05$). In first third of incubation there was not significant difference ($P>0.05$) between the groups in mortality. The lowest middle embryonic mortality was in group R4 (0.00%), however, the lowest late embryonic mortality was in group R0 ($P<0.05$). Due to preincubation, embryonic development shifted from 10 to 10.1 after 2 hours of preincubation, after 5 hours to 10.3 ($P<0.05$). It was concluded that in hatching eggs stored for 10 days the pre-heating did not improve the hatching quality and day-old chick weight.

Key words: *Embryonic development, Storage period, Chick quality, Embryonic stage.*

EFFECT OF GENDER ON BASIC MEAT PRODUCTION PARAMETERS IN LAMB CARCASSES

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Abstract

The main aim of present study was to evaluate the effect of the gender on basic carcass parameters in lambs (n = 24) of the Romney Marsh breed. An integral part of our study was the evaluation of the influence of gender on the growth of lambs. In all monitored intervals the daily gain (DGs) was higher in male lambs (MLs). However, the gender had a significant effect only on birth weight and DG from birth to the slaughter. The gender of lambs did not have a significant effect on body condition score, depth of *musculus longissimus lumborum et thoracis* (DMLLT) and thickness of backfat (TBF). However, values for DMLLT and TBF were higher in female lambs (FLs), which in case of DMLLT was not expected. Regarding the carcass traits, the gender had a significant effect only on the weights of kidney, kidney fat, leg and shoulder and on the proportions of kidney fat and shoulder. On the other hand, the gender had no significant effect on the conformation and fatness, which was not expected, when slightly better carcass conformation and slightly higher fatness were found in FLs. In conclusion, it can be generally stated that FLs of the Romney Marsh breed had comparable values of most carcass traits with MLs of the same breed. Moreover, a slightly higher fatness of FLs is a prerequisite for better juiciness and tenderness of their meat, when this fact can be considered as a benefit in the marketing.

Key words: *lamb, gender, growth, carcass, ultrasound measurements.*

THE INFLUENCE OF AGE ON QUALITATIVE AND QUANTITATIVE PARAMETERS OF STALLION EJACULATE

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Abstract

Qualitative and quantitative parameters of stallion ejaculate are influenced by various factors. The age of stallion is one of them. The aim of this study was to evaluate the effect of stallion age on the ejaculate gel-free volume, concentration, motility and sperm morphology. The total number of 15 stallions of various breeds housed in the Tlumačov Regional Stud Farm were included in this research. The total number of evaluated ejaculates was 103. Stallions were divided into three age categories (3-7 y, 10-14 y, 18-20 y). The highest values of ejaculate gel-free volume were reached by the group aged 10 to 14 years (57.33 ml) and the lowest values were reached by the group of the oldest stallions (34.17 ml) ($p \leq 0.05$). Stallions from the age category 10-14 y also achieved the highest values of sperm concentration (254.21 * 10^6 / ml). The lowest sperm concentration was measured in the age group of the oldest stallions (197.07 * 10^6 / ml). The oldest age group (18-20 y) achieved the highest values of sperm motility (86.57%) while the lowest values were achieved within he youngest age group of stallions (79.27%). Differences in sperm concentration and motility were not statistically significant. The highest values of spermatozoa with normal morphology were reached by the oldest age group (89.64%), while the lowest values were reached by the youngest group from 3 to 7 years (85.22%) ($p \leq 0.05$). The effect of age on ejaculate parameters was demonstrated in both sperm volume and morphology. Therefore, the age of the stallion should be taken into consideration when evaluating stallion ejaculate.

Keywords: *Stallion ejaculate, Age, Sperm, Volume, Concentration, Motility, Morphology.*

THE PRODUCTIVE PERFORMANCE AND BLOOD ATTRIBUTES OF MAGHRABIAN DROMEDARY CAMEL INFLUENCED BY DIFFERENT BREEDING SYSTEMS

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Abstract

An increase in both human population and economic growth has been accompanied by rising per capita demand for animal products. The livestock industry including camel is under pressure to meet this demand. This study was undertaken to investigate the effect of different breeding systems (extensive, intensive and semi-intensive) on the productive performance and blood attributes of Maghrabian dromedary camel. This study was carried out at the private farm located in the North Coast of Egypt using 30 Maghrabian male dromedary camels. Animals were divided into three equal groups, first group were housed under intensive breeding system (IBS), while the second and third groups housed under semi-intensive (SIBS) and extensive breeding systems (EBS) for 6 months. Live body weight, daily growth rate as well as blood biochemical parameters were investigated currently. Results indicated a significant ($P \leq 0.05$) increase in grazing frequency and duration for SIBS as compared with two other breeding systems. A greater ($P \leq 0.05$) increase in diarrhea frequency and mastitis incidence were noticed for EBS in comparison with the IBS and SIBS. Live body weight and daily growth rate were higher ($P \leq 0.05$) for camels raised under SIBS other than EBS and IBS. Greater ($P \leq 0.05$) serum total protein, albumin, globulins, total bilirubin uric acid concentrations were observed for camels raised under EBS, while, urea concentration was higher in IBS. Non-significant variations were noticed in serum glucose and creatinine concentrations among three breeding systems. Serum zinc and calcium concentrations were greater ($P \leq 0.05$) in EBS than SIBS. In conclusion, the productive performance and blood parameters were better for SIBS other than traditional EBS for camel in Egypt. Camel owners should be encouraged to convert to SIBS for better productive performance.

Keywords: *Breeding systems, Productive performance blood, Camel, Egypt.*

EFFECT OF WATER SALINITY ON GROWTH PERFORMANCE, SURVIVAL RATE, FEED UTILIZATION AND BODY CHEMICAL COMPOSITION OF PACIFIC WHITE SHRIMP (*LITOPENAEUS VANNAMEI* BOONE, 1931) JUVENILE

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Abstract

This study was conducted to investigate the effect of water salinity, (5, 15, 25 and 35‰) on growth performance, survival rate, feed utilization and body chemical composition of Pacific white shrimp (*Litopenaeus vannamei*) juvenile under the water environment of Qaroun Lake. Survival rate was within the range 90–98.75%, with insignificant differences ($P \leq 0.05$), were observed. Results of growth performance parameters were highest with shrimp reared in water salinity 5 ‰ compared tothe other salinities 15, 25 and 35 ‰. The best FCR (lowest) was recorded with shrimp reared in water salinity 5 ‰. The worst FCR was recorded with shrimp reared in water salinity 35 ‰, with insignificant differences between 15, 25 and 35 ‰. The lowest bodyprotein content was recorded with shrimp reared in water salinity 5 and 15 ‰. Also, the highest content of bodyether extract was recorded with shrimp reared in water salinity 5 and 15 ‰ compared tothe other salinities 25 and 35 ‰. These results indicated that the best growth rate forshrimp was obtained at reared in water salinity 5 ‰, then water salinity 15 ‰ followed by water salinities 25 and 35 ‰ under experimental conditions.

Key words: *Pacific white shrimp, water salinity, growth performance, feed utilization, body chemical composition, survival rate.*

THE DIFFERENTIATION OF BEEKEEPING PRACTICES SUCH AS WITNESSES TO THE EVOLUTION OF THE RELATIONSHIP BETWEEN BEEKEEPING AND AGRICULTURE WITHIN THE TERRITORY AND SYSTEMS OF ACTIVITIES

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Abstract

In Hopelchén, Mexico and in the rest of the world, beekeeping is in decline. The civil society points the finger at the evolution of agriculture towards a simplified and capital-intensive way of exploiting the soil, which leads to the biological devaluation of the ecosystem. These hypotheses are confirmed by the evolution of the relationship between bees and agriculture in Hopelchén. The green revolution has made two activities, which were once symbiotic, competitive both spatially and biologically. In this context of important agricultural intensification, we wonder which strategies are adopted by the beekeepers to maintain and develop their activity. The results lead us to the following observations. The social rules within the study area have been forged in response to the need for productive factors necessary for the practice of slash-and-burn. With the transformation of agriculture, the balance of production factors changes and the social rules, which are not adapted, have become a source of inequality in access to the resource. There are two categories: ejidatarios, who have the upper hand, and communeros, who are deprived of certain rights. This polarity generates four types of activity systems, ranging from the ejidatario with large cultivable spaces and agricultural machinery to the communero practicing activities outside the village. This differentiation between social classes is carried over to the scale of the apiary, since the strategies implemented by the ejidatarios make use of the resources acquired through their social position. The communeros sell their labor according to reciprocal exchange patterns.

Keywords: *Beekeeping, Mexico, Adaptation, Beekeeping system, Apiculture business system, Agriculture, interaction.*

EFFECTS OF PHYTOGENIC POLYPHENOLS IN FEED - A REVIEW

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Abstract

Phytogenic polyphenolic compounds have hydroxyl groups on one or more benzene rings. A broad spectrum of bio-effectivity entails their use in animal nutrition and as feed additives. Phytogenic, phenolic pigments attract visually oriented animals, like poultry, and increase feed intake. The astringent taste of many phenols can foster saliva excretion, enhance appetite, and palatability of feed. Anti-microbial properties, deriving from various bindings of the OH-groups to proteins, help to defend against pathogens and can shift positively the microbiom of the animals' gut. Protein modulation may decrease protein digestibility and cause an anti-nutritive effect in monogastrics. In ruminants, the same effect can help to maintain an optimal ruminal pH by forwarding bound, undegraded proteins to a later stage of digestion. The radical scavenging ability and anti-oxidative effect can support the animal's health, particularly in stress situations, e.g. cows in the peri-parturition phase, high environmental temperature, etc. Polyphenols can intercalate with DNA and suppress signalling pathways of inflammation transcription factors, e.g. NF-κB, thereby decreasing intrinsic response and saving energy for growth and performance. They may enhance quality of the animal product, such as meat, egg or milk by attenuating lipid oxidation, extending shelf life, or decreasing cholesterol content in the yolk. The similarity with the mammalian hormone oestrogen may cause disturbances of fertility of female farm animals - an undesired effect of isoflavones of legumes. However, there is a lack on exact knowledge on how and to which extent digestive processes degrade polyphenols. Therefore, predictability of effectivity of polyphenolics in feed is limited.

Key words: *Animal nutrition, Feed additive, Phenolic, Phytogenic*

SUSTAINABLE BREEDING STRATEGIES FOR CLIMATE CHANGE ADAPTATION FOR THE HONEYBEE

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Abstract

Several honeybee subspecies are adapted to arid climates, but the majority of them are threatened by extinction, due to their lower productivity and less gentle behaviour. These characteristics have rendered them less attractive to beekeepers, so that they were replaced and/or bastardized. This represents a serious loss for our capability of coping with already difficult environmental conditions, which will become even more serious if climate change worsens the actual climate. There is no alternative, but to preserve the genetic resources that are still available and to adapt them both to changes in the climate and to the needs of beekeepers. As an immediate measure, sperm cryopreservation of these endangered subspecies is recommended. This technique has been made available recently and is already being used in the USA and Germany. *Ex-situ* and *in-situ* conservation are not mutually exclusive. Cryopreserved genetic resources can play an important role in the support of *in-situ* programmes. As in other animal species, traditional performance testing will continue to play an important role in the selection for climate change adaptation. However, in the light of the expected speed and extent of the climatic change, this approach is likely to be insufficient. Modern methods of comparative sequencing of different honeybee subspecies can be used to discover gene variants that enable socially organized resistance to climate-related changes. Recent molecular genetic approaches will not only expand our understanding of the genetic architecture of climate-driven adaptation, but also will provide efficient tools for selective breeding towards this aim.

Keywords: *Honeybee, Climate change adaptation, Breeding strategies.*

TERATOGENICITY TESTING OF CHLORPYRIFOS AND TEBUCONAZOLE IN CHICKEN EMBRYOS AFTER SIMULTANEOUS ADMINISTRATION

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Abstract

The objective of this study was to determine the single and simultaneous toxic effects of chlorpyrifos containing insecticide formulation (Pyrinex 48 EC) and tebuconazole containing fungicide formulation (Mystic 250 EW) on the development of chicken embryos. Amount of 0.1 ml of 1% Pyrinex 48 EC and of 0.4% Mystic 250 EW was alone and concomitantly injected into the air chamber of eggs on the first day prior to incubation. The chicken embryos were examined on day 19 of incubation for the followings: number of embryonic deaths, body, liver and heart weight of the embryos, and type of developmental anomalies. The body, liver and heart weight data were evaluated statistically by One-Way ANOVA, Tukey and Dunnett tests, the embryonic mortality and the developmental abnormalities were analysed by Fisher's exact test. The combined administration of Pyrinex 48 EC and Mystic 250 EW pesticides on the chick embryo had shown to be embryotoxic to the chick. The rate of mortality and the incidence of developmental anomalies were increased due to the simultaneous application of them. The body and liver weight were significantly reduced. Our teratogenicity study revealed that the combined administration of both chlorpyrifos (Pyrinex 48 EC) and tebuconazole (Mystic 250 EW) pesticides on the chick embryo had shown to be embryotoxic to the chick. They had a slight addition effect on the rate of embryonic mortalities, however, the toxic interaction of both pesticides on developmental anomalies, liver and body weight was not proven.

Keywords: *chlorpyrifos, tebuconazole, teratogenicity, chicken embryo, developmental anomalies.*

CYTOLOGICAL EVALUATION OF MILK IN BOVINE MASTITIS: A PILOT RESEARCH

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Abstract

Beside metabolic diseases and foot disorders, bovine mastitis causes the highest economic impact in dairy herds. Mastitis diagnostics are traditionally based on physical examination together with somatic cell count (SCC) determination, although recent studies have highlighted that these diagnostic tools alone are not sufficiently sensitive in several cases. This pilot research aimed to study the cellular composition of bovine milk samples with high SCC, applying traditional cytological evaluation methods, in order to determine the type and severity of ongoing inflammatory processes. During a twelve-week-long study milk samples were collected from five Holstein Friesian and five Hungarian Simental caws on a weekly basis. After samples were centrifuged, cytological smears were made from cellular sedimentation, following Romanowsky-type staining light microscopic examination carried out by which differentiation of inflammatory cells, determination of cellular ratio as well as pathologic lesions were possible. From 120 samples 87 showed clear inflammatory cytological appearance, including 20,7% suppurative, 27,6% pyogranulomatous, 2,3% granulomatous and 49,4% mixed inflammation. Beyond determining the types of inflammation, our research allowed to follow up the progression of pathologic processes at individual level during the whole examination period. According to SCC and cytological appearance two cows showed recovery, two cows presented regression, while the other six cases were constant. However, the numbers of sampled animals were quite low and most of the results showed high variances thus they could not be considered significant. The applied diagnostic methods seemed to be appropriate enough to serve as a basis for further, more extended investigations in mastitis diagnostics.

Keywords: *mastitis, cytological evaluation, somatic cell count, inflammatory process, milk.*

POST THAW QUALITY AND VIABILITY OF VITRIFIED IMMATURE OOCYTES USING DIFFERENT CRYOPROTECTANT CONCENTRATIONS IN SHEEP

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Abstract

Cryopreservation of oocytes through vitrification is quite successful but oocyte vitrification is still being standardized because of their structural and molecular sensitivity to the cooling and freezing process. The present study was conducted with the objective of evaluating different cryoprotectant concentrations on post-thaw morphology and viability of immature oocytes in sheep. Vitrification was done in three vitrification solutions using different concentration of cryoprotectants (Ethylene Glycol + DMSO) i.e. 20% (G1), 30% (G2) and 40% (G3) mixture of Ethylene glycol and DMSO in equal ratio in open pulled straw. Post vitrification evaluation was done after one week storage in liquid nitrogen based on morphological evaluation and viability using trypan blue dye. The present study revealed non-significantly higher percentage of morphologically normal oocytes in G3 (74.7%) followed by G2 (70.3%) with lowest percentage in G1 (66.6%). Morphological defects observed were 33.3 %, 29.6% and 25.2% in 20% (G1), 30% (G2) and 40% (G3) vitrification solutions respectively, with non-significantly higher percentage in 20% vitrification solution group. However, viability of post thaw immature oocytes was 95.6%, 84.4% and 81.1% in G1 (20%), G2 (30%) and G3 (40%) respectively, with significantly higher ($P<0.05$) viability in G1 (20%) and lowest in G3 (40%). High cryoprotectant concentrations maintain normal morphology and minimize cryoinjuries to vitrified immature oocytes with negative impact on viability of oocytes which may be avoided by reducing the exposure time of oocytes to high cryoprotectant concentrations.

Keywords: *Vitrification, immature oocytes, Cryoprotectants, Morphology, Sheep.*

POST THAW IN VITRO MATURATION OF VITRIFIED IMMATURE OOCYTES IN SHEEP USING DIFFERENT CRYOPROTECTANT CONCENTRATIONS

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Abstract

Vitrification of oocytes as a method of cryopreservation is quite successful but it is still being standardized because of structural and molecular sensitivity of oocytes to the cooling and freezing process. The present study was conducted with the objective of evaluating different cryoprotectant concentrations on post-thaw in vitro maturation rate of vitrified sheep oocytes.Vitrification was done in three vitrification solutions using different concentration of cryoprotectants (Ethylene Glycol + DMSO) i.e. 20% (G1), 30% (G2) and 40% (G3) mixture of Ethylene glycol and DMSO in equal ratio in open pulled straw. Post IVM rate was evaluated after one week of storage in LN2 based on cumulus cell expansion with D2 expansion being considered as mature oocytes. In the present study, 152, 152 and 125 oocytes were recovered post thaw with 133,141,117 morphologically normal oocytes in G1 (20%), G2 (30%) and G3 (40%) vitrification solutions respectively, which were then subjected to IVM. The present study revealed significantly higher percentage of in vitro maturation rate of post thaw oocytes in G1 i.e. 20% (D1: 52.6%, D2: 48.87%) followed by G2 i.e. 30% (D1: 11.34%, D2: 32.6%) with lowest percentage in G3 i.e. 40% (D1: 8.5% and D2: 26.4%). In conclusion, high cryoprotectant concentrations decrease the maturation rate of vitrified immature sheep oocytes which may be avoided by reducing the cryoprotectant concentrations or reducing the exposure time of oocytes to high cryoprotectant concentrations.

Keywords: *Vitrification, Immature oocytes, Cryoprotectants, In-vitro maturation, Sheep.*

GROWTH PERFORMANCE AND KLEIBER RATIO OF MECHERI SHEEP UNDER SMALL HOLDER MANAGEMENT SYSTEM OF TAMIL NADU

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Abstract

Studies on sheep growth based on live weights over a relevant economic time period are subjects of major interest among animal scientists and producers. Due to the lack of information on growth patterns in Mecheri lambs, this study was undertaken to evaluate the growth performance and feed efficiency by identifying the important non-genetic factors for designing management and improvement programmes under farmer's field conditions. The data collected on body weight of 2202 Mecheri lambs (1153 ram lambs and 1049 ewe lambs) reared under farmers field conditions for a period of 10 years were utilized. The overall least-squares mean (±SE) for body weights at birth, weaning, 6 month, 9 month and 12 month were 2.41 ± 0.01, 10.59 ± 0.08, 13.97 ± 0.10, 16.97 ± 0.11 and 20.20 ± 0.13 kg, respectively and the average daily gain (g) in body weight for 0-3, 3-6 and 6-12 months were 90.78 ± 0.83, 37.53 ± 0.78 and 32.59 ± 0.50, respectively. The least-squares means (±SE) for Kleiber ratios for 0-3, 3-6 and 6-12 months were 15.25 ± 0.06, 5.10 ± 0.10 and 3.37 ± 0.04, respectively, which indicated that the animals at early ages were more efficient in food conversion. Non-genetic factors viz., year of birth, season of birth had very important role in the development and growth of the Mecheri sheep, at different ages/growth stages, necessitating correction of records to increase the accuracy of selection. The pre-weaning KR may provide good scope for indirect selection in Mecheri sheep for better weight gain.

Keywords: *Feed efficiency, Growth traits, Mecheri sheep, Kleiber ratios, Non-genetic factors.*

EFFECT OF OLIVE LEAVES FEEDING ON PHENOLIC COMPOSITION AND PROTEASE ACTIVITY IN GOAT MILK

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Abstract

The aim of this study was to evaluate phenolic composition and theactivity of matrix metalloproteinase-9 (MMP-9)in raw milk obtained from goat fed a dietary supplementation with olive leaves (OL), a by-product of the olive oil production chain. MMP-9 is a zinc-dependent proteolytic enzyme which in mammals is involved in several physiological and pathological events, and its presence in milk may be associated with inflammatory events affecting the mammary gland. For this purpose, 30 Saanen goats were randomly allocated into two groups of 15 goats each: the control group received a standard diet, whereas the experimental group (EG) was fed for 30 days with an OL-supplemented diet (10% on a dry matter basis). The results showed a positive effect of dietary OL supplementation in modifying the phenolic composition in milk; specifically, 19 phenolic compounds, including phenolic acids, flavonoids, simple phenols, and secoiridoids, were identified in EG milk. In addition to this, the zymographyc approach showed a reduced activity of MMP-9 in EG milk, a finding that led us to hypothesize an inhibitory action of the identified phenolic compounds toward this enzyme. The use of the molecular docking approach specifically showed the potential ability of cinnamic acid to interact with the catalytic zinc ion of the enzyme, interfering with the recruitment of the substrate and therefore, slowing down its hydrolytic activity. In any case, this information will be subjected to in vitro evaluations for an accurate characterization of the biochemical mechanisms that can be established in milk naturally enriched with bioactive compounds.

Keywords: *Goat milk, Phenolic compounds, Cinnamic acid, Matrix metalloproteinase-9.*

SILAGE PRODUCTION FOR RUMINANTS USING AGRO-INDUSTRIAL BYPRODUCTS

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Abstract

In line with the green and circular economy, there is growing interest in the use of agro-industrial by products as feed for ruminants. Ensiling is regarded as a suitable method to improve the nutritional value of by-products to be efficiently incorporating into diets for livestock production and to reduce feeding cost. This study was carried out to investigate the use of wheat straw (WS), grape pomace (GP), milk whey (MW) and olive mill waste water (OMWW) as byproduct-mixed ingredients to produce silage for ruminants. Three mixtures of by-products were used corresponding to the following ratios of WS, GP, MW and OMWW, respectively: 40:20:40:0, Mix1; 40:20:35:5, Mix2; 40:20:32.5:7.5, Mix3. Commercial lactic acid bacteria inoculant was used as silage additive. Chemical composition, fermentation characteristics and total phenolic content (TPC) of the silage mixtures were determined after 40 days of storing. As a silage quality index, Flieg points were calculated. No differences ($P>0.05$) were found for the proximate chemical composition and fiber fractions content among the three investigated by-product mixtures. The pH value ranged between 4.22 and 4.44 ($P>0.05$). The OMWW addition at 5% increased the lactic ($P<0.01$) and acetic acid ($P<0.05$) contents. The highest TPC value was obtained for Mix3 containing 7.5% OMWW(1.08±0.21 g GAE/kg d.m.; $P<0.01$). According to the Flieg's index, Mix1, Mix2 and Mix3 produced high quality silages. It can be concluded that ensiling of agro-industrial byproducts such as WS, GP, WM and OMWW can be used as a suitable method to produce feed-resource with environmental benefits.

Keywords: *Agro-industrial byproducts, Silage, Feed, Ruminants.*

CHARACTERIZATION OF THE RUMEN MICROBIOTA IN SAANEN GOAT KIDS FED OLIVE LEAVES

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Abstract

This study examined the effect of a dietary integration with olive leaves (OL), a by-product of the olive industry, on ruminal microbial community of Saanen goats. Twenty goat kids were randomly divided in two groups of ten goats each. The control group (CTR) was fed with a standard diet, whereas the experimental group (OL+) received a custom-formulated diet containing 10 g/100 g on dry matter (DM) of OL. After 30 days of trial, genomic DNA was extracted from the rumen liquor and prepared for 16S rRNA-gene sequencing to characterize the rumen microbiota. The Shannon's alpha index was not significantly different between the two groups, on the contrary, Bray Curtis ($P < 0.01$) and Jaccard ($P < 0.01$) distances evidenced that feed affected microbial community in the rumen. Eleven genera were influenced by olive leaves integration, *Paludibacter, Fibrobacter, Sphaerochaeta Christensenella, Rikenella, Oligosphaera, Candidatus Endomicrobium, Anaerovorax, Atopobium* increased, while the percentages of *Bacteroides* and *Selenomonas* were reduced. Differences were also observed between the two groups at family level ($P < 0.004$). Fibrobacteriaceae, Christensenellaceae, Coriobacteriaceae, Oligosphaeraceae, Candidatus Endomicrobium, and Planctomycetaceae were significantly higher in goats on OL diet than that on CTR, while the levels of other identified families, Succinivibrionaceae and Bifidobacteriaceae were opposite. Finally, results showed that ruminal bacterial community of the two groups was dominated by Bacteroidetes and Firmicutes, but no significant differences in relative abundance of any phyla were observed between the two groups.

Keywords: *Rumen microbiota, Goat, Olive leaves, 16s rRNA, Metagenomic.*

BALANCED FEEDING AFFECTS THE MINERAL CONTENT OF AWASSI SHEEP MILK

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Abstract

Dairy sheep farmers in Middle Eastern countries are constrained by high feeding costs. The traditional sheep feed rations are based mainly on barley grain. The offered diet is often rich in energy and unbalanced in protein content. It has been demonstrated that locally available feeds like cotton seed cake (CSC), molasses, sugar beet pulp (SBP) and urea-treated wheat straw (UTS) can be utilized to formulate balanced diets (BD). This study examines the effects of BDs on the content of calcium, phosphorus, sodium, potassium in Awassi sheep milk which play an important role in human health. Four BDs (CSC, CSC-UTS, SBP and SBP-UTC based diets) were compared with a traditional (control) diet at the International Center for Agricultural Research in the Dry Areas in Syria. Awassi ewes were randomly assigned to groups and were kept on grazing as a basal diet. Milk samples were collected in spring. Diet affected significantly the mineral content of the milk. In SBP diet, the milk content of calcium was increased by 5.5% compared to the control diet. Diets containing UTS resulted in a decrease in phosphorus content by 3-5%. Potassium increased by 7% in SBP-UTS diets, while the content of sodium decreased by 8-12% in all BDs. In general, phosphorus and sodium contents increased with the advance of lactation, while the calcium and potassium contents decreased. Feed diets affected the milk mineral content significantly. Especially the increased calcium content through including SBP in the sheep diet and reducing sodium content through balancing diets would contribute positively to human health.

Key words: *milk minerals, agro-industrial by-products, Awassi sheep milk.*

BEE COLONY SWARMING EVENT DETECTION IN PRECISION BEEKEEPING

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Abstract

Honey bee colony swarming event is a good example of an animal group performing a synchronised action with aim to leave the original hive and depart for a new location. Swarming has always been seen by the beekeepers as an extremely important event, which requires an immediate response. During the swarming majority of the bees leave the hive and this dramatically reduces the productivity potential of the colony and profitability of the beekeeper. Thus, remote detection of this event should be done by application of the bee colony monitoring system within the precision beekeeping approach. Remote monitoring of bee colonies helps to reduce the stress and unnecessary activities of bee colonies by minimising the number of visual inspections. There are several technological possibilities for remote detection of swarming. During the swarming event temperature in the colony increases, overall hive weight decreases and there is a specific sound emitted by the colony. Within this article various parameter dynamics are summarised and demonstrated for the successful identification of the swarming event. We summarised findings from various literature sources and also provide our own experimental results conducted for the swarming detection.

Keywords: *Precision beekeeping, Precision apiculture, bee colony swarming, remote swarming detection, bee colony monitoring.*

INFLUENCE OF BREED AND SEASON ON GOAT MILK AMINO ACIDS AND FATTY ACIDS

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Abstract

Milk protein and fat content and their composition (amino acids and fatty acids) are the main milk components that makes an impact the nutritional and technological quality of goat dairy products such as fresh milk, cheese and yoghurt. Objective of the work – to investigate the influence of factors on milk protein and fat composition of the dairy goats. This scientific research work was carried out in 2020 in the Animal Breeding Department of the Lithuanian University of Health Sciences (LUHS) and dairy goat farm in Lithuania. The investigations were conducted with the Alpine, Saanen and Anglo-Nubian goat breeds.Analyses of the amino acid and fatty acid composition of goat milk were carried out in the Chemical Laboratory of the Livestock Farming Institute of the LUHS with SHIMADZU gas chromatographer. The total of 64 samples of goat milk were assessed during the investigations. Statistical analysis was performed with statistical package SPSS. Results were considered to be reliable when $p < 0.05$. It has been established, in this study, that the highest content of essential and nonessential amino acids was in the milk delivered by the Anglo - Nubian breed and the lowest content – by Saanen breed of goats ($p < 0.001$). The most significant difference in terms of saturated acid content was estimated in the Saanen, compared to Alpine breed ($p < 0.05$). Analysis of variance: single – factor and multivariate – factor (ANOVA, MANOVA) revealed that the goat breed and season showed a statistically reliable impact on amino acid and fatty acid content ($p < 0.001$).

Keywords: *Goat, milk, amino acids, fatty acids.*

FERMENTATION AND MICROBIAL DYNAMICS OF PERENNIAL GRASSES SILAGE PREPARED WITH BIOLOGICAL INOCULANT

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Abstract

Ensilage provides an effective means of conserving green forage to supply as feed to ruminants. The fermentation process presented in the ensilage process depend on lactic acid bacteria (LAB). Silage quality is variable and the only way to effectively control the fermentation process, to improve the ensiling process and the quality of the resulting silage is to use an additive, mostly biological inoculants with LAB. The aim of this study was to evaluate the fermentation and microbial dynamics of perennial grasses silage with biological inoculant. Alfalfa and *Poaceae* mixed grasses were ensiled. Into grass silage was added biological additive, consisted of mixture of homofermentative and heterofermentative LAB and enzymes. Inoculant included strains *Lactobacillus plantarum, Pediococcus acidilactici, Pediococcus pentosaceus, Propionibacterium acidipropionici,* α-amylase, β-glucanase, cellulase and hemicellulase. The fermentative quality, chemical composition parameters and microbiological counts of silages at 7, 14, 21 and 60 days after ensilage were evaluated. Fermentation dynamics were examined using chemical analysis. The study showed higher values of dry matter, crude fat and NDF after supplementation of biological additive in all analyzed samples. Conversely, there was a reduction of the pH and water soluble carbohydrates concentration. Ensiling caused an increase of acetic acid concentrations as well ($p<0.001$). There were found significant differences ($p<0.05$) in contents of NEL between 21 and 60 days of ensiling after treatment and between the control group of fresh grass and 7 and 21 days after treatment as well. At the 7 day of fermentation process there was a significant increase in *Lactobacillus* spp. abundance ($p<0.001$) and on 60 day there was a decrease in *Clostridium* spp. abundance ($p<0.001$).

Key words: *Silage, Inoculant, Lactic acid bacteria, Enzyme, Fermentation.*

EVALUATION OF MILK YIELD AND MILKING CHARACTERISTICS OF DIFFERENT GENOTYPES DURING LACTATION IN ORGANIC FARMS

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Abstract

Dairy cattle on organic farms are still selected on the basis of information from conventional systems. Productivity of cows differs between organic and conventional herds, therefore, the ability of cows to adapt to an organic production environment has been questioned. The aim of this study was to investigate the milk yield and milk ability traits during lactation of Lithuanian black & white and Holstein cows with different genotypes in organic farm. The research was carried out in organic farm in 2020 with dairy cows (n=364) of different genotype of Lithuanian black and white cattle population. The milk yield (MY), milking speed (MS), highest milk flow (HMF), milking time (MT) were evaluated. Investigated traits were measured with DeLaval electronic milk meters, "Apro Windows" software. All records were between five and 305 days of lactation. The statistical analysis of data was performed using the SPSS 20.0 (SPSS Inc., Chicago, IL, USA) software package. A probability of less than 0.05 was considered significant ($P<0.05$). We observed that a highest MY and HMF in organic farm was detected in cows with a genotype of Lithuanian Black and White breed (LB&W, LB&WxH and LB&WxHxLB&W) during all stages of lactation. MT of these cows during the first two stages of lactation was longer, compared to cows of other genotypes. We estimated that of all fixed effects the biggest influence on MY, MS, MT was by stage of lactation ($P<0.001$); a genotype showed a highest impact on MT($P<0.001$) and MY($P<0.01$).

Keywords: *genotype, milk yield, milk flow, milking time.*

PRODUCTIVITY DYNAMICS AND RELATIONSHIP BETWEEN QUANTITATIVE AND QUALITATIVE INDICATORS IN COWS OF THE HOLSTEIN BREED

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Abstract

The article presents the results of a study of the milk productivity of Holstein cows in the dynamics of lactations, correlation between the level of milk yield, fat content, and the amount of milk fat, live weight and milk ratio. The studies were carried out in the herd of the breeding farm of SLL (Society of limited liability), „Doksancom" on Holstein cows in the dynamics of 4 lactations. A comparative analysis of the yield of cows in the dynamics of lactations showed that during the second lactation, milk productivity was 934 kg of milk, the third - 959 kg of milk, the fourth - 1527 kg of milk more than in the first lactation, the difference being significant at P <0.01, P <0.05 and P <0.001, respectively. The lactation curve of all analyzed cows of the Holstein breed of the herd of SLL „Doksancom" changed with a certain regularity and had a leveled character, characterized by a high stable type. The relationship between milk yield and the percentage of fat in milk of cows of first-fourth lactation was in negative correlation from weak (-0.187, second lactation), moderate (-0.338 – -0.486, first-fourth lactation) to noticeable (-0.557, third lactation). A negative correlation in the entire analyzed animal population was found between milk ratio and live weight, ranging from mild -0.018 to moderate -0.334. This will allow further selection of highly productive cows in the herd with an optimal live weight for the Holstein breed.

Key words: *milk productivity, fat content, lactation, live weight, correlation*.

ALTERNATIVE CELLS FOR ISOLATION, DETECTION AND PROPAGATION OF CAPRIPOX VIRUSES

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Abstract

Our work focuses on the comparison of the sensitivity of four primary cells of different tissues (heart, skin, kidney and testis) with Vero, OA3.Ts and ESH-L cell lines to three capripoxviruses LSDV, SPPV and GTPV. Three primary cells (Heart, Skin, Kideney; LT cells) and three cell lines (Vero cells, OA3.Ts cells and ESH-L) were used in this study. Fifteen PCR positive field samples taken in the acute phase of CaPVs diseases were used for viral detection. Three CaPVs, were used for growth kinetic: LSDV, SPPV, and GTPV. Specimens were diluted in PBS, centrifuged for 20 min and the supernatant was retained for inoculation on confluent cells. After 45 min of adsorption, inoculated cells were incubated and observed daily for CPE presence. The evaluation of cell sensitivity was based on virus titration and PCR. The titer of CaPVs was determined using the titration method based on direct CPE observation, IPMA and IFA. Our results show that ESH-L cells and primary fetal heart cells present the highest sensitivity for CaPVs growth and detection. Vero cells can replicate those viruses but without showing any CPE while the titer obtained on OA3.Ts is lower than primary and ESH-L cells. ESH-L cells are an effective alternative to primary cells use for growing Capripoxviruses and their diagnosis.

Key words: *Capripoxviruses, Cell sensitivity, ESH-L cells, Primary cells, Immunoenzymatic staining and immunofluorescence.*

THE PREVALENCE OF SELECTED GENES AND MULTIDRUG RESISTANCE IN *CAMPYLOBACTER* SPP. ISOLATED FROM DOGS

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Abstract

The aim of the study was to determine the role of dogs as a potential reservoir of *Campylobacter* spp. At the next stage of the research the frequency of occurrence of selected virulence genes, i.e. *cadF*, *flaA* and *iam* as well as genes responsible for the formation the cytolethal distending toxin (CDT), i.e. *cdtA, cdtB* and *cdtC* was determined. The isolates obtained in the research were tested for their resistance to selected antibiotics: ciprofloxacin (CIP), enrofloxacin (EF), erythromycin (E) and tetracycline (TE). Rectal swabs were collected from 500 dogs (n = 250 dogs younger than 1 year and n = 250 dogs older than 1 year). *Campylobacter* spp. was found in 63 (12.6%) out of a total number of 500 isolates. 61 (12.2%) isolates were identified as *C. jejuni*. The number of *C. jejuni* isolates found in the younger animals was smaller (P <0.05) than in the older ones. The frequency of occurrence of virulence genes and the genes responsible for the formation of CDT was significantly (P <0.05) higher in the older dogs. A comparison of the effect of antibiotics showed that the isolates obtained from both age groups exhibited low resistance to erythrosine (13.5% in the group aged under 1 year and 8.6% in the group aged over 1 year). Both groups exhibited the highest resistance to ciprofloxacin and enrofloxacin.

Keywords: *Campylobacter, Multidrug resistance, Toxin CDT, Virulence genes.*

RESEARCH ON THE MANAGEMENT OF DAIRY BREEDING IN A FARM IN THE DORNELOR BASIN IN ROMANIA

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Abstract

The paper aims to highlight the management of dairy cattle breeding on a farm in the Dornelor Basin, Suceava County, with the strengths and problems encountered in this farm. The farm is located in Panaci commune, Coverca village, with 60 head of cattle for milk, comprised of the following breeds: Bălțată Românească, Brună, Bălțată cu Negru Românească and Pinzgau. The paper is based on data taken from the National Register of Holdings on 23.10.2020. Data were statistically processed in the following indicators: dairy cow heads, heifer heads, female and male youth heads, daily milk/cow head production, total/lactation production, percentage of milk fat and protein, number of mountain products benefiting from the optional status of "mountain product". From the processed data it appears that the problems of this farm are represented by the insurance of the feed base, the lack of qualified personnel and the main advantage is represented by the fact that the farmer capitalizes the milk production obtained from cattle on the farm.

Keywords: *cattle, farm, milk, mountain product, dairy products.*

STUDY OF MILK PRODUCTION INDICES IN MARAMUREȘ BROWN BREED EXPLOITED AT THE SECUIENI NEAMȚ AGRICULTURAL RESEARCH AND DEVELOPMENT STATION

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Abstract

In this scientific paper, the analysis of milk production indices was performed, on standard lactation (305 days) in maturity equivalent (MS), on successive lactations, in the Brown breed of Maramureș raised and exploited at the Secuieni - Neamț Agricultural Research and Development Station. This breed of cattle belongs to the mixed morphoproductive type of milk - meat and was formed following the crossing between cows from the primitive local breeds Sura de steppe and Mocănița with bulls of the Schwyz or Brown Alpina breed (originally from N-E Switzerland). Cattle of this breed have a high degree of adaptability to all areas of relief, especially those of hill and mountain specific to the area of Neamț County, high productive longevity - is up to 12-13 years. For the analysis of milk production indices, data from accredited associations were used to perform the official control of milk production (COP): the Association of Animal Breeders "Operator I.A" Neamț, as well as data from the Genealogical Register. An average milk production of 5840.00 kg was registered on normal lactation, with a minimum production of 5275.00 kg and a maximum production of 7043.00 kg. Regarding the milk fat and protein content, the results recorded we also satisfactory, respectively, the average fat percentage was 4.09%, with a maximum limit of 4.42% and a minimum of 3.57%, and the percentage of registered protein had an average value of 3.41% with a maximum limit of 3.75% and a minimum limit of 3.10%. Regarding the fat/protein ratio, it recorded values of 1.19, a value that is close to the normal limits of this breed (1.20). The results obtained for the bulls of the Brown from Maramureș breed raised in this farm demonstrate that at optimal maintenance and feeding conditions this breed of cattle expresses its genetic potential very well.

Keywords: *cattle, milk production, fat percentage, protein percentage, COP.*

STUDIES ON ABERDEEN ANGUS BREEDING SYSTEMS AND LIVESTOCK IN ROMANIA

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Abstract

In our country, cattle are raised profitably and sustainably. The breeding system of cattle in our country is largely extensive, because the trend of consumers is that towards an organic, quality meat. The Aberdeen Angus cattle breed offers many advantages to breeders: it is robust and easy to maintain by extensive grazing, without providing concentrates, it achieves a consistent meat ratio to a medium weight carcass. These characteristics are a competitive advantage in an era in which good management, low production costs and high quality products determine the success of a business in animal husbandry. In this context, there is a need and opportunity to optimize the exploitation of cattle, following a complex and creative analysis of all the factors and links that make up the exploitation technology. Romania, is the second country in the European Union as pasture area, the large area of pasture, climate, relief, variation of precipitation, soil, quality of animal feed are some of the great strengths of farmers to raise beef cattle extensively. Romania has 238,391km2: 31% mountains, 36% hills and 33% plains; and all of us we need fresh beef in the European Union, with fair traceability and without importing from South America. The number of Angus in Romania is constantly growing, so if in 2008 there were only 200 heads, now in our country there are about 15000 heads, of which 11000 purebred heads and over 1,800 mestizos, according to MADR.RO.

Keywords: *breeding system of cattle, Aberdeen Angus, quality products, livestock.*

INFLUENCE OF BACTERIA BACILLUS AND INACTIVATED YEASTS ON PHYSIOLOGICAL PARAMETERS AND HONEY PRODUCTIVITY OF BEES

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Abstract

In order to find effective and safe ways to prevent the weakening and death of bee colonies, it is necessary to focus on the stimulation of physiological processes in the body of bees, activating their own mechanisms of resistance. *Bacillus subtilis* and *Bacillus licheniformis* are related species of gram-positive bacteria. Reproducing in the intestinal lumen, these bacteria produce all important digestive enzymes (proteases, amylases, lipases, pectinases, cellulases), which have antimicrobial and antitoxic effects, and also stimulate metabolic processes in the macroorganism. The inactivated yeast *Saccaromyces cerevicaea* was used as a protein and vitamin component of the supplement, since it contained all the essential amino acids and was easily digested by insects, stimulating the oviposition of queens. It was found that the addition of supplements containing probiotic bacteria Bacillus and inactivated yeast culture to bees' feeding increased the activity of digestive (proteases) and detoxifying (non-specific esterases, glutathione-S-transferases) enzymes in the body of bees. It also significantly affected macro indicators such as the development of the fat body, increasing the level of its development by 45%. The field research has shown that the honey productivity per family increases 6.9-fold compared to the control and 1.9-fold compared to the analogue. The results obtained indicate the broad possibilities of using this supplement composition for apiculture.

Keywords: *Probiotics, Apiculture, Bacillus, Saccaromyces cerevicaea.*

GENETIC IMPROVEMENT OF PRODUCTION AND REPRODUCTION TRAITS OF PIGS

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Abstract

The main method of pig breeding is the three breed cross system; on first stage use of Large White and Landrace pigs, for which Litter traits are priority. Reproductive traits have a low coefficient of heritability. In this regard, it is necessary to develop individual methods of assessment, and take into account the traits of productivity and breed-specific characteristics. The aim of the work was to find SNPs associated with the Litter traits of Large White and Landrace. Studies were carried out on purebred sow of Large White (n=200) and Landrace (n=200) bred in a Russian farm. To select SNPs, we used data from genomic studies presented in databases and scientific literature. Specific oligonucleotide primers for SNP identification were designed using Primer-BLAST (https://www.ncbi.nlm.nih.gov/tools/primer-blast/). Localization of SNPs and genes was determined by NCBI Sus scrofa 11.1. Then SNPs, which showed polymorphisms within the studied groups of Large White and Landrace pigs, were selected. Some of them were localized in genes which biological functions were related or influence the development of productive traits. It is interesting to note that SNP rs80956812 (SSC1: 164,674,664) is localized in *SMAD6* (SSC1: 164,657,086-164,734,703), SNP (rs81471381) (SSC18: 53,985,856..54,283,220) near *SUGCT*; SNP (rs80891106) near RF00001 (73234200..73234325) and ENSSSCG00000032058 (73861910..73911853); SNP (rs81421148) in *AKT3* (SSC10: 16441465..16741745); SNP (rs81319839) near *MTBP* (SSC4: 18,535,841-18,609,163). Based on the results of the analysis, the distribution of allele and genotype frequencies across SNPs in Large White and Landrace was determined, and the effects of SNPs genotypes on Litter traits of sows were determined.

Keywords: *SNP, Litter traits, Large White and Landrace.*

Acknowledgments: The current work was performed in accordance with the State task of the Ministry of science and higher education 121052600358-5 (0445-2021-0008).

THE RELATIONSHIP BETWEEN CATTLE METABOLISM AND QUALITY OF FEED RATION

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Abstract

The purpose of given research was to study the quality of grass fodder (hay, silage, haylage), harvested in the farms of Perm Region in 2017-2020 and to determine the relationships between cattle metabolism and quality of feed ration. According to the results of the studies, corn silage from 56% of the samples did not comply with national standards for dry matter (DM) - the content was below 20%. Thirteen batches have high content of acetic and butyric acid. Herbaceous fodders with higher quality were obtained from leguminous plants. Haylage in plastic packaging is the highest quality forage among the fodders harvested in the farms of the region – 92% of total volume batches of tested feed received the high quality degree. This type of fodder is characterized by high energy concentration – up to 13.33 MJ/kg per kg DM, as well as an increased content of crude protein in DM – up to 23.29%, especially batches from goat's-rue (*Galega orientalis*), alfalfa and mixture of clover and alfalfa. Unbalanced diet and low nutrient digestibility led to metabolic processes violation in cows organism, which was expressed in the form of ketosis and alkalosis noted for 90-95 % animals of the dairy herd. The scientific novelty of the work enclose detailed study of biochemical composition of fodder prepared in Perm Region and their influence on the metabolic processes in the body of animals.

Key words: *herbaceous fodders, legume hay, corn silage, haylage, exchange energy, protein.*

STUDY OF THE DYNAMICS OF BETA-HYDROXYBUTYRATE AND HEPATO-SPECIFIC MARKERS IN THE BLOOD OF NEWLY CALVED COWS WITH DIFFERENT BODY CONDITION

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Abstract

Most cows have an increase in ketone body production a few days before calving. After calving, the prerequisites for ketogenesis are even more enhanced in cows. Lack of glucoplastic substances in the diet leads to the mobilization of fats and the development of ketonemia and liver lipidosis. We carried out a study in newly calved cows in the conditions of livestock farming in the Leningrad region (Russia). Two groups of 12 cows were formed. The criterion for the formation of groups is fatness (BSC) at the beginning of the dry period (in the first group - over 3.75, in the second group - 3.0-3.5). Blood samples were taken three times - 3-5 days after calving, then twice more with an interval of two weeks. In the blood serum, the content of BHB, total bilirubin, bile acids, as well as the activity of the enzymes AST and GGT were investigated. Studies have shown that in cows in both groups, the dynamics of changes in ketones, bilirubin and bile acids is unidirectional, but in cows with increased body condition these indicators were higher. Immediately after calving, the difference between the groups for these parameters was 21.3, 36.6 and 10.8%, respectively. The maximum values were determined 2-3 weeks after calving, then their decrease was observed. One month after calving, in cows with increased body condition, the activity of AST and GGT was higher by 19.2 and 16.0% in comparison with the indicators of cows in the second group. The results obtained confirm the negative effect of obesity in cows at the end of pregnancy on metabolic processes after calving.

Keywords: *Cows, Blood serum, Biochemical parameters, Metabolism, Body condition.*

THE PHYTOBIOTIC EFFECT OF NETTLE (Urtica Simensis S.) ON THE GROWTH OF CHICKEN "COBB 500"

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Abstract

In this paper, the influence of ground nettle leaves as a phytogenic supplement in broiler nutrition on production results and growth parameters was examined. The diet test was performed according to the principle of group control and lasted 42 days. One-day-old Cobb 500 provenance chickens were used for the experiment, and tests were performed on chickens of both sexes with an average body weight of 48.67 ± 2.49 g. The experiment was performed on a total of 120 broilers divided into 4 groups of 30 chickens. That is, the chicken was divided into control group K (no phyton-nettle supplement), experimental O-I group (phytogen-nettle supplement, 1%), experimental O-II group (phytogen-nettle supplement, 1.5% in food) and experimental O-III group (with phytogen-nettle supplement, 2% in food). In fattened chickens the best result of body weight was found in chickens of experimental groups: O-III those consuming food with the addition of 2% nettle (2658.94 g), O-II those consuming food with the addition of 1.5% nettle (2450.00 g) and O-I those consuming food with the addition of 1% nettle (2330,20 g) relative to the control group K having the lowest body weight (2120.10 g).; Average food consumption was highest in the O-I trial (128.00 kg) compared to the control group consuming more food (12.70 kg) compared to the O-II (121.60 kg) and experimental groups O-III (112.23 kg). Obtained food conversion results per kilogram increment show that the experimental group O-III receiving nettle supplement of 2% had the best food conversion per 1 kg increment (growth 1.37 kg / kg) compared to the experimental groups receiving nettle supplement of 1.5% (1.66 kg) / kg growth), ie. nettle content in the mixture of 1% (growth of 1.77 kg / kg). The worst results were shown by the control group consuming food without adding nettle.

Key words: *broilers, phytogenic additives, nettle, conversion, growth.*

COW MILK INSULIN LIKE GROWTH FACTOR-1: RISK OR BENIFIT FOR HUMAN HEALTH?

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Abstract

Cow milk is widely consumed by human children and adults. The health benefits of the macronutrient and micronutrient content of milk are well established and include increased bone mineral content, and reduced risk of protein-deficiency malnutrition. Besides nutrients, milk contains bioactive substances that may alter their level in children and adults blood. The impact of bioactive substances in milk, including insulin like growth factor-1 (IGF-1), on human health has been little investigated. Human IGF-1 and bovine IGF-1 are chemically similar and allows bovine hormone to be biologically active in humans. Several studies have demonstrated IGF's intact oral absorption and plasma bioactivity in neonate and adults and high milk consumption is associated with up to 20% increase in circulating IGF-1 levels among adults and up to 30% increase among children. Higher circulating levels of IGF-1 are associated with increased risk of a number of cancers, including prostate, breast and colon cancer. However, higher IGF-1 levels are also associated with increased bone mineral density, favorable effects on bone remodeling in adults and on bone mineral content in children. Also, lower IGF-1 levels in adults have been linked to heart disease, diabetes and unfavorable changes in body composition in later life. In conclusion, any recommendations related to cow milk consuming should await a more complete understanding of the long-term effects of IGF-1 on human health and more conclusive evidence on the relationship between milk diet and IGF-1.

Keywords: *cow, milk IGF-1, human health.*

THE HONEY AND ENVIRONMENT

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Abstract

The paper presents potential residues of polychlorine biphenyls (PCBs) and sulfonamides in honey. Investigation was performed analyzing 20 samples of acacia and meadow honey. The samples were collect from 4 different parts of Republic of Srpska (RS), Hercegovina, Romanija, Doboj and Karajina region. For determination of residual levels of polychlorine biphenyls, gas chromatography with electron-capture detection (GC/ECD) was used. Analysis of sulfonamides was done with ELISA test in honey (5-600 μg/kg). Results indicate that in the described beekeeping zones very small amount of investigated residues in honey were detected. Also the results are evaluated with current regulations: Commission Regulation (EU) n 37/2010; Official Gazette of BiH, No. 89/12, 92/17 and 21/19 and Official Gazette of the FRY No. 5/92 and 11/92". Honeybees are the main indicators of the environment. Where pollution with toxic gases is high, honey bees find it difficult to survive, which is also a sign that the environment is endangered. Therefore, by raising honey bees, people protects nature and themselves as someone who belongs to nature and its environment. The analysis in 4 regions of RS has determined the ecologically clean environment that provides an opportunity for the development of beekeeping in the other parts of the state.

Keywords: *Honey, polychlorine biphenyls, sulfonamides, residues, environment.*

CORRELATIONS BETWEEN THE QUANTITY OF FORAGED POLLEN, THE NUMBER OF FORAGERS AND THE MORPHOLOGICAL TRAITS OF THE HONEY BEES

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Abstract

In four-year monitoring of two generations of honey bee colonies (queen bees and their offspring), the correlation coefficients between morphological traits for the amount of foraged pollen, traits on which the foraging activity of honey bees depends. Considering morphometric traits, the tongue length, the length and width of the wings and basitarses were measured. In field conditions, scouts and forager bees were counted, the total amount of foraged pollen and the amount of foraged alfalfa pollen were measured. It was found that there is a very strong correlation between the amount of foraged pollen and the observed traits that determine the foraging activity of the honey bee, as well as the size of the basitarus at a statistically very significant level ($p < 0.01$). There was a strong correlation between the traits that determine the foraging activity with each other ($p < 0.01$). The size of the basitarsus (length and width) was strongly correlated with most traits. The wing length was in medium correlation with most traits ($r = 0.3$-0.6), while the wing width with all traits was weakly or negatively correlated. The length of the proboscis was in the medium strong correlation with most of the observed traits. It is weakly correlated with the width of the basitarus and the wing, and weakly to negatively correlated with the wing length.

Keywords: *honey bee, correlation coefficients, pollen foraging, morphological traits, number of foragers.*

A NEED FOR THE INTRODUCTION OF THE PIG CARCASS CLASSIFICATION SYSTEM IN THE REPUBLIC OF SERBIA

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Abstract

The Republic of Serbia has a long tradition in the pig production. Serbia is one of the few countries in the region with the notable pig production without the implemented system for categorization of carcasses based on the lean meat content. Some of the ex-Yugoslavian countries started with the implementation of this system in the late 1990-s while the challenges of implementation of carcass classification is still in front of Serbia. The purpose of every pig breeding program is in the function on the increase in animal performance to obtain as many as possible of fattening pigs in as short as possible period with the good characteristics of the carcasses. There is a characteristic situation in Serbia. There are two types of producers: 1) large scale farms with the huge production of fattening pigs per year and 2) relatively important number of small, family orientated farms with small capacity, especially in Vojvodina, the north part of Serbia. However, meat processing industry is very concentrated and five meat processing plants take about 80% of the all market. Producers who invested in the breeding program are not rewarded and do not have stimulation for the further improvement. Moreover, some meat processing plants started to implement the carcass classification system. However, it put the producers even in more depending position toward the meat industry. There is a need for the introduction of carcass classification system by the independent body in the Republic of Serbia.

Key words: *pig production, carcass classification system.*

QUALITY OF TABLE EGGS OF WHITE AND BROWN SHELL

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Abstract

Since the white shell eggs are present in the domestic market, it is necessary to examine their quality in order for consumers to be adequately informed, especially because they have certain prejudices against white shell eggs. The purpose of this study was to examine the effects of genotype (brown or white layers) on the table eggs quality after storage of 28 days. Total of 60 eggs from two strains of laying hens (Hisex brown and Hisex white) were sampled and the first set of 15 eggs were examined first day after laying. The second set of 15 eggs per strain was stored in a refrigerator (4°C) and examined after storage period of 28 days. The following egg quality parameters were evaluated: egg weight, shell breaking force, albumen height, Haugh units (HU) and yolk color. The results showed no significant differences in egg quality parameters between white and brown shell eggs neither in fresh eggs nor after storage. However, in both strains the storage significantly affected the albumen height (6.34 vs. 5.46 mm in brown eggs; 6.74 vs. 5.64 mm in white eggs) and HU (76.87 vs.70.40 in brown eggs; 79.11 vs. 71.44 in white eggs). pH values of albumen were not significantly affected by storage (9.14 vs.9.35 in brown eggs; 9.37 vs. 9.42 in white eggs). The results suggest that the albumen height and the HU significantly decreased during storage in both white and brown shell eggs.

Key words: *Brown eggs, White eggs, Storage, Quality.*

INFLUENCE OF REARING SYSTEM ON THE CARCASS TRAITS AND CARCASS CONFORMATION OF FATTENING CHICKENS

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Abstract

The aim of the research is to determine the slaughter characteristics and carcass conformation of chickens reared in the conventional production system or in organic production. Random samples of 6 carcasses from each production system were taken for the determination of basic slaughter traits: carcass weight, yield and percentage of individual carcass parts and weight and share of abdominal fat. The following characteristics of carcass conformation were measured: abdominal wall thickness, breast depth, keel length, breast angle, breast girth and drumstick girth. Also, pH values of breast and drumstick meat were determined. The collected data were analyzed by ANOVA, using Fisher LSD post hoc test, in the program Statistica, TIBCO, version 14. The results showed that the system of meat production had a significant effect on most of the examined parameters. Chickens raised in conventional system had significantly higher carcass weight and consequently higher weight of the all carcass parts. The share of breast was higher in birds from conventional system, while the share of the wings, thighs and back was higher in organic chickens. The content of abdominal fat was significantly higher in organic chickens. Regarding the carcass conformation organic chickens had significantly lower values compared to conventional ones for all examined traits. The results confirmed that there is a significant difference in carcass quality and yiled of different carcass parts between organic and conventional chickens which could have a strong influence on consumers preferences.

Key words: *Chickens, Carcass, conformation, Organic production*

THE IMPACT OF ORGANIC PRODUCTION OF GEESE ON THE ENVIRONMENT THROUGH THE PRISM OF EU LEGISLATION

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Abstract

The authors present the specifics of organic production and its impact on the environment when it comes to poultry production - geese. Geese are characterized by modesty in terms of breeding conditions and they are a type of poultry that enters breeding relatively late, characterized by modest egg production during the season, while the results suggest a general conclusion that the age of geese has a significant impact on egg fertilization and laying goose, as well as the mass of eggs, and thus the final product. Having in mind the characteristics of geese that significantly distinguish them from other poultry, it is important to point out the minimized negative impact on the environment of this type of production, which was carried out according to the standards of the Common Agricultural Policy of the EU. Organic production provides high value products certified as organic food, which increases the price of a unit product, reduces consumer health risks and enables the entrance on the global market.

Key words: e*nvironmental protection, European Union, Geese production, Organic production, Poultry production.*

EFFECTIVE POPULATION SIZE AND INBREEDING RATE OF HOLSTEIN POPULATION IN VOJVODINA AUTONOMOUS PROVINCE (SERBIA)

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Abstract

Holstein populations around the world are facing an increasing inbreeding rate. Despite being the most numerous dairy breed worldwide, Holstein effective population sizes are quite small. This is a result of intensive use of artificial insemination and high selection pressure. Recent data show that after the introduction of genomic selection, the inbreeding rate started increasing even faster. Results of inbreeding are well described in dairy cattle. Inbred cows have lower milk yield, worse reproduction parameters, and shorter survival in production. The objective of this study was to examine the inbreeding rate and population size of the Holstein population registered with the cattle breeding organization in Vojvodina province, Serbia. The pedigree file was formed for 36,733 animals born between 2013 and 2017. Inbreeding coefficients and effective population sizes were calculated using PopRep software (FLI). The average inbreeding coefficient steadily increased from 0.51% to 1.08% during the period observed. Effective population size was stabile when calculated according to a number of parents, with an average of 4,643 animals. Effective population size, obtained by the method of computing the relationship matrix with uncertain parentage, which was method proposed by software, was small and decreasing, ranging from 120 to just 65 in the period observed.

Key words: *Effective population size, inbreeding, Holstein cattle.*

THE HEAVY METALS IN THE LIVER OF FATTENING PIGS AND MANGULICA IN THE REGION OF VOJVODINA, SERBIA

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Abstract

Meat and meat products are an important part of daily nutrition of human population. They are an important source of minerals and nutrients essential for human nutrition. Heavy metals are pollutants that, in some cases, can be found in meat and meat products. Lead (Pb) and cadmium (Cd) are heavy metals without any functions in animal organism. Their concentration is regulated through the legislation. The edible offal, like liver, is at the higher risk of the increased amount of Pb and Cd. The allowed concentration for Pb and Cd in liver is 0.5 mg/kg in the Republic of Serbia. The aim of the study was to determine the concentration of Pb and Cd in the liver of fattening pigs (22) and Mangulica (6) from different locations in Autonomous Province Vojvodina, Serbia. Fattening pigs (three breed hybrids) were reared in intensive condition on the formulated feed on sixteen different farms in Vojvodina. They were slaughtered at the age of six months, approximately at 105-110 kg of live weight. Mangulica were from two different locations, reared extensively without any formulated feed. They were slaughtered at the age of two years and at about 100 kg live weight. In all analyzed liver samples, the concentration of cadmium was in the allowed range. However, Pb concentrations in 10 liver samples of fattening pigs and in 4 liver samples of Mangulica exceed the allowed concentration.

Key words: *Lead (Pb), Cadmium (Cd), Fattening pigs, Mangulica pigs.*

DEFINING THE ECONOMIC VALUE OF THE TRAITS INCLUDED IN THE METHODS FOR THE ASSESSMENT OF PIGS GENETIC POTENTIAL

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Abstract

The objective of this paper was to describe a methodological procedure for defining the economic value of primiparous sows production and reproductive traits, of which some were used for assessment of sows breeding value. This is a novel methodological procedure whose purpose is to reduce the influence that constant changes both in production cost and price of fatenners may have on selection work and to enable planning of long-term selection strategy in pig breeding. The obtained economic value is presented as a relative relationship between the changes in costs per unit of the trait and a primary trait, when the traits achieve the values defined by selection goal wherein the expenses are unknown value regarded for one feeding day. In this way the obtained economic value defines selection pressure and gives the trait the significance wished for by a selectionist without regarding it through the profit realized in the production expressed in money, which is still of a variable character in developing countries, thus allowing for its use as an indicator in calculating the genetic parameters.

Keywords: *trait economic value, selection index, pigs, methodological procedure to obtain economic value, genetic potential.*

THE EFFECT OF ADDITIONAL FEEDING ON PRODUCTION TRAITS OF HONEYBEE COLONIES

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Abstract

Honeybee meets its nutritional needs by consuming nectar and pollen. A cold and rainy weather in early spring causes the deficiency of suitable nutrition. The aim of present research was to study different kinds of stimulating nutrition on traits of bee colonies. Trial was carried out in April and May during 2021. Three groups were formed with eight equalized bee colonies in each group. Bee colonies were thoroughly examined at the onset and at the end of trial period. Upon the end of acacia pasture the yield of honey per bee colony was determined. To the first group (I) of bee colonies pollen traps were placed. This group was stimulatingly fed with patties that contained three parts of brewer yeast, three parts of sugar and two parts of water. During 21 days bee colonies got three patties each weighing 250 g. The second group (II) of bee colonies was stimulatingly fed with 300 ml sugar syrup (50: 50%) every second day with restriction of up to 15 days before the beginning of acacia pasture. The third group (III) of colonies was a control group. After 21 days bee colonies stimulatingly fed sugar syrup had on average by 12% more bees than colonies of the two other groups ($P>0.05$). The first group had by about 4 and 9% less brood in relation to II and III group ($P>0.05$). The highest average yield of honey after acacia pasture (9.91 kg) was determined in group II and it was significantly higher ($P<0.05$) compared with the yield in I and III groups (4.37 and 5.81 kg). The study on the effects of additional nutrition in the period of development of bee colony and of attaining adequate strength up to the first main acacia pasture in Serbia becomes very important subject both in the conditions of climate changes and variable climate conditions during the early spring.

Keywords: *Honey bee, Stimulating nutrition, Brewer yeast, Sugar syrup.*

Acknowledgment: Authors are grateful to the Serbian Ministry of Education, Science and Technological Development for providing Grants 451-03-9/2021-14/200116.

THE EFFICIENCY OF USE OF OXALIC ACID AND THYMOL IN BEE COLONIES AGAINST *VARROA DESTRUCTOR* DURING AN ACTIVE SEASON

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Abstract

Varroa destructor is one of the main threats to beekeeping at the world level. Since it is deemed very important that number of varroa in bee colony should be decreased as much as possible, the application of alternative acaricides has been studied both during an active season and in the presence of a bee brood. The objective of the research was to study the efficiency of oxalic acid diluted in glycerine and of thymol solution on cellulose carrier on decreasing the varroa in an active season. Trial was carried out in the period from the end of June to the middle of August. Two groups of bees were formed with six bee colonies in each. Oxalic acid was diluted in heated glycerine. Each cardboard strip soaked solution of 7.5 g oxalic acid mixed with 12.5 ml glycerine. The first group colonies were treated with 4 strips each. In the second group bee colonies were treated by a commercial preparation which cellulose boards contained 1 g of thymol each three times in the interval of 7 days. Counting the falling mites was done every three days during a whole 21 day period. After that all colonies were treated with coumaphos strips (Check Mite+). In the next 30 days counting a decreased varroa was continued. The efficiency of treatment was determined by comparing the number of decreased varroa during the first 21 day with the number of total decreased varroa during a whole period including coumaphos treatment. An average number of daily decreased varroa of 1.79 in the second group was significantly higher ($P<0.05$) in relation of daily decreased mites 0.79 in the first group. The efficiency of treatment in the second group accounted for 24% while in the first group it accounted for 15%. Although the efficiency of synthetic acaricides is significantly higher in suppressing varroa, their use is not allowed in the active season period so the only choice are so-called ecological acaricides which can help reducing the number of mites in bee colony.

Keywords: *Honeybee, Oxalic acid, Thymol, Varroa destructor.*

Acknowledgment: Authors are grateful to the Serbian Ministry of Education, Science and Technological Development for providing Grants 451-03-9/2021-14/200116.

THE INFLUENCE OF FORAGE AND CONCETRATE RATIO IN THE DIET ON ESSENTIAL FATTY ACID CONTENT IN COWS MILK FAT

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Abstract

The overview of domestic and foreign investigations was given in the paper about the influence of forage and concentrate ratio in the diet on production and chemical composition of milk, and on the polyunsaturated fatty acid (PUFA) content in cows milk fat. Special attention was given to conjugated linoleic acid (CLA) because of its proved antidiabetic and anticarcinogenic properties. Green forages like pasture has positive effect on PUFA content, but significantly decreases milk synthesis. Increase in milk yield can be achieved with the increase in quality forage and/or with the increase of concentrates in the diet. There are differences between various forages, so that grass and legume silages have more favorable effects on milk fat synthesis and fatty acid profile compared to maize silage. The increase of energy in the diet with the aim to increase milk yield can be achieved with the use of carbohydrate (starch) and feeds high in oil. High starch content in the diet provides lower production of volatile fatty acids (acetic and β-hydroxibutyric), which are used for *de novo* synthesis of fatty acids (<16:0) in the udder. The result of such feeding regime is decrease of PUFA and CLA content in milk fat. The use of some high oil feeds in the concentrates increased PUFA content significantly. Among the investigated species (soybeans, sunflower, linseed, cotton see, peanuts) the highest increase in CLA content (by 60%) was obtained with heat processed soybeans, compared to control ($p<0.01$).

Key words: *feeding, cows, milk, fatty acids.*

DETERMINATION OF EXTERNAL, INTERNAL AND PROPERTIES OF EGGSHELL QUALITY

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Abstract

Eggs of class "L" produced of Isa Brown genotype were used for the research needs. The research aimed to determine the external (length, width, shape index and mass of eggs), internal (proportion of main parts of eggs, albumen height, Haugh units and yolk color) and eggshell quality parameters (purity, thickness and strength). The eggshell strength was determined by applying the direct method of puncture, using a specially constructed measuring and acquisition device. The results of the research showed that the average egg length was 58.33 mm, width 45.17 mm, and shape index 77.44. Of the average egg mass (65.79 g), the albumen proportion was 59.87%, yolk 27.33% and eggshell 12.90%. Albumen height ranged from a minimum of 4.42 mm to a maximum of 6.76 mm, with a coefficient of variation of 16.90%. Accordingly, values of the Haugh units ranged from 60.2 to 80.2 and the coefficient of variation of 10.96%. The average yolk color was 13 Roche. The purity of the eggshell was rated 4.44. The eggshell quality of the tested eggs was quite uniform because the average puncture force of the eggshell was 25.88 N, with a coefficient of variation of 4.20% and an average thickness of 0.40 mm. Knowledge of the values of external, internal and properties of eggshell quality can be used in a selection of laying hens hybrids with increased eggshell strength, as well as for cage construction, design of egg collection equipment and design of egg packaging.

Keywords: *hen eggs, egg quality, eggshell puncture force.*

EFFECT OF SELENIUM FROM FOOD ON PHEASANT MEAT QUALITY

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Abstract

In this paper we examined the effects of usage of organic selenium in the nutrition of pheasants on breast meat quality in the experiment that lasted for two months. Forty five pheasants were divided into three groups of 15 pheasants, and were fed with mixtures of organic selenium supplementation in concentrations of 0.2 mg/kg (I group) and 0.3 mg/kg (II group), while the food of the control group was without selenium supplementation. The obtained results showed that the introduction of organic selenium into pheasant mixtures did not have statistically significant effect ($p>0.05$) on the average breast meat weight and chemical composition of meat: water, fat, protein, pH and ash content. Organic selenium in a concentration of 0.3 mg/kg of the mixture had a positive effect on increasing the water holding capacity of the breast meat and on sensory traits compared to meat of the control group and the I group which was fed with 0.2 mg/kg of organic selenium in the mixture. The ability of water retention in breast meat of the II group of pheasants was higher than in control group by 0.75% i.e. 0.58% in comparison to I group. Sensory traits of breast meat of the II group of pheasants were for 15 points better than sensory traits of meat of the control group, that is for 7 points better than the I group of pheasants. Statistically significant differences were determined among the average values of selenium concentration in white breast meat of II group pheasants ($p<0.05$) and the control group of the pheasants which are fed without selenium supplementation.

Keywords: *organic selenium, meat quality, pheasant.*

QUALITY AND SENSORY PROPERTIES OF WHITE-BRINED GOAT CHEESE

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Abstract

The aim of this study was to examine the influence of different starter cultures on the composition and sensory characteristics of white-brined goat cheeses. Four varieties of cheese (A, B, C, D) were produced according to the same technological procedure. Quality parameters, with special emphasis on the dynamics of ripening, were determined after production, on the 10th, 20th and 30th day of ripening. Since the cheeses were produced from full-fat goat's milk, after the ripening period, they belonged to the group of full-fat cheeses (with a fat content in the dry matter higher than 45%). As a result of different starter cultures, in variants A and B intensive proteolysis occurred after 20 days of ripening, while in variant C increase of Ripening Index was observed after 10 days. The most intense proteolytic changes were found in variant A at the end of ripening period, where the soluble nitrogen (SN) content in 12% TCA was 154.9 mg%, while the lowest intensity of proteolytic changes was determined in variant B with the average SN content in 12% TCA of 116.3 mg%. The best sensory evaluations were given to cheese variants B and C, which were evaluated with excellent quality (4.92 and 4.56), while cheese variants A and D had very good quality (4.47 and 4.36).

Key words: *goat milk, cheese in brine, sensory quality*

SPOILAGE POTENTIAL OF PASTEURIZED MILK MICROBIOTA

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Abstract

The aim of this study was to evaluate the spoilage patterns of pasteurized milk microbiota. Additionally, the microbiological quality of raw and pasteurized milk regarding total aerobic and psychrotrophic counts was assessed. Samples were collected from two dairies at the milk reception point and different sites along pasteurized milk production line. Total aerobic and psychrotrophic counts in raw milk samples from Dairy 1 and 2 were at similar levels (approximately 6-7 log CFU/ml). The pasteurization step significantly reduced the total mesophilic bacteria counts. Samples from both dairies did not contain a detectable level of culturable psychrotrophic bacteria before the filling. However, psychrotrophic count in milk packages from Dairy 1 increased from 0,66±0,26 log CFU/ml to 3,76±0,19 at the end of the shelf-life. Forty-eight isolates with the different colony morphology selected from plate-count agar plates were screened for spoilage potential under laboratory conditions. The most prominent enzymatic trait (64,58% isolates) was proteolytic activity. Out of 17 enzymatically active isolates, 10 isolates were successfully identified as following: *Bacillus pumilus* (n=3), *Bacillus licheniformis* (n=2), *Leifsonia aquatica* (n=2), *Pseudomonas oryzihabitans* (n=2) and *Bacillus megaterium* (n=1). More stringent hygiene is required at each step of the dairy production chain to achieve a high microbiological quality of raw and pasteurized milk and to control spoilage microbiota.

Key words: *pasteurized milk, microbiota, spoilage potential.*

THE OCCURRENCE OF SUBCLINICAL MASTITIS AT SELECTED FARMS

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Abstract

Mastitis, mainly subclinical, is the great problem in dairy farms. The aim of the study was to evaluate the occurrence of subclinical mastitis at selected two sheep farms and investigate relation between pathogen presence and somatic cell count (SCC). The study was performed at two dairy farms. The first farm kept Lacaune and the second farm kept Tsigai breed. The samples were collected six times from each farm within six months. Totally 587 milk samples at half udder level were collected, 180 samples from the first and 407 samples from the second farm. Only healthy ewes free of clinical mastitis were included in the study. SCC was determined using the Fossomatic 90 (Foss Electric, Hillerød, Denmark). Samples were cultured on blood agar (MkB Test a.s., Rosina, SR). MALDI-TOF MS (Bruker Daltonics, Germany) used for the identification to species level (Project No. KEGA 039SPU-4/2019). Intramammary infection was detected in 22.22% of milk samples at the first farm and in 36.11% at the second farm. Among udder halves with intramammary infection, there were 89.84% positive for coagulase-negative staphylococci (CNS). The most common CNS species was *Staphylococcus* (*S.) chromogenes* (24.63%) at the first farm and *S. simulans* (32.35%) at the second farm. *S. aureus* was identified at the second farm (5.44%). The bacteriological positive samples had significantly higher SCC compared to the bacteriological negative samples ($P < 0.001$). High SCC indicates the health of udder and therefore it could improve the detection of mastitis in ewes.

Keywords: *ewes, mastitis, pathogen, somatic cell count.*

ANTIMICROBIAL EFFECT OF COMMERCIAL POMEGRANATE POWDER ON BULL SEMEN MICROBIOTA

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Abstract

Antimicrobial agents are added to semen extenders to prevent growth of bacteria in semen. The aim of this study was to evaluate the antimicrobial potential of fresh pomegranate juice (PJ) and reconstituted commercial pomegranate powder (PP), on the microbiota collected from bull semen. Bacterial broth (BB) was made from 25 bacterial strains isolated from semen of one bull. The treatments were created using three ratios of BB and PJ (1:0.5; 1:1; 1:2), in addition to BB and PP (1:1); three concentrations of PP were assessed (5%, 10%, 20%). The PP and PJ were filtered to exclude bacterial contamination. Bacterial growth was determined after 0 and 24 hours of exposure at room temperature. Antimicrobial efficiency was determined from bacterial counts (logarithmic colony-forming units; CFU per mL) before and after incubation for 72 hours at 30°C. The experiment was repeated three times. Multiple T test and ANOVA Dunnett`s multiple comparison test (GraphPadPrisma 7.00) were performed to analyse the date. Confidence interval $P<0.05$ was defined as statistically significant. An antimicrobial effect was seen for all tested groups at 0 h exposure compared with controls except for BB: PJ (1:0.5). A reduction in bacterial numbers was found for BB:PJ (1:2), BB:PP 10% and BB:PP 20% compared with control after 24 hours of exposure. No antimicrobial effect was seen for PJ 1:0.5, PJ 1:1 and PP 5%. Based on these results, PP could be used to reduce bacterial numbers in bull semen provided that it does not have a deleterious effect on sperm quality.

Keywords: *Punica granatum, bull semen microbiota, antimicrobial effect.*

CURRENT SITUATION OF ANATOLIAN BUFFALO HUSBANDRY AND BREEDING POSSIBILITIES IN VAN PROVINCE OF TURKEY

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Abstract

Livestock sector in Van province of Eastern Anatolia is an important source of income for the local people. The objective of this survey is to present the current situation and the potential of buffalo husbandry and breeding opportunities in Van province of Eastern Anatolia in Turkey. However, it is possible to say that water buffalo breeding has decreased considerably for last years. Even though this is the case, especially buffalo husbandry is indispensable for indigenous people. Van province is one of the most prominent cities of this area in which its public sustain themselves by animal production, because there are many wetlands in Van province. For this reason, buffalo husbandry should be expanded in Van province. According to the results of research, the dilemma as such as low yield in buffalo, low number of animals raised, limited marketing opportunity, insufficient reproductive cycle of the animal, insufficient technical knowledge, inadequate cooperatives, inadequate and expensive veterinary service are most problems to create efficient breeding programs. According to the data of 2020, there are a total of 1001 head buffalo in Van province. In Van province of Eastern Anatolia, buffalo husbandry participates with 0.71% in general livestock production in Turkey with very low share. Anatolian buffalo breed is more common in this region. Anatolian buffalo, among Mediterranean water buffalo which are subgroup of river buffalos, is raised in Turkey. Milk yield, lactation period, birth weight of calves, and daily live weight gain during feeding in Anatolian buffaloes are 800-1000 kg, 200-250 days, 30 kg, and 550-600 g, respectively. The buffalo milk from this breed is consumed by the household as raw milk. As a result, the preservation and the development of Anatolian buffalo breed as a genetic source is very important. Water buffalo breeding needs to be developed in Van province.

Keywords: *Buffalo milk, Husbandry, Improvement, Van province, Water buffalo.*

OCCUPATIONAL HEALTH AND SAFETY CULTURE IN ANIMAL PRODUCTION IN TURKEY

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Abstract

Animal production has an important place in agricultural activities. The aim of this review is to provide sensitivity about occupational health and safety, accidents, diseases, and musculoskeletal disorders in animal production sector in Turkey. It is also aimed to provide suggestions for occupational health and safety that increase production in animal breeding. The livestock activities in Turkey have been characterized by the different regional applications. Animal production is associated with a variety of occupational illnesses and injuries. The issue of occupational health and safety in animal production is very important as it is in many other areas. In practical work related to crop and livestock production to ensure safety and to prevent accidents at work, it is important to take necessary precautions. In such an environment and in a certain direction, employees are exposed to occupational accidents. Farm workers can often experience unavoidable health problems and even death may occur. In addition, there is also a risk of contracting an occupational disease that may occur in the future in livestock farming. The most common hazards at the animal production in Turkey are the zoonotic diseases, the ergonomics, the noise, the air conditioning, the chemicals, the animal attacks, the bites, the injuries, the accidents in transport, the psychological stress, and the skin-borne diseases. Especially, the animal hitting and the zoonotic diseases are very important in animal husbandry. Therefore, the precautions related to the occupational health and safety must be taken for the workers at the livestock enterprises, the field, and the factories dealing with the feed, skin, and meat. In Turkey, preventive measures have started to be taken on occupational health and safety in livestock production. This information has been prepared based on the personal observations and the experiences directly in the local area.

Keywords: *Animal production, Occupational disease, OHS culture, Zoonotic disease.*

NOMADIC ACTIVITIES OF SMALL RUMINANT HUSBANDRY IN MUŞ PROVINCE OF EASTERN ANATOLIA IN TURKEY

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Abstract

In this survey, the nomadic life culture and the nomadic small ruminant husbandry in Muş province of the Eastern Anatolia Region in Turkey have been discussed. Also, detailed information about nomadic families in Muş province dealing with stockbreeding activities has been given. This information has been prepared based on the personal observations and the experiences directly in local area. Stockbreeding activities of nomadic and semi-nomadic tribes have been examined. The migrants are mostly from Şırnak, Batman, Mardin, and Siirt provinces to the Muş highlands. These migrants make as pedestrian their arrival and return to the plateau. Shepherds in their family are responsible for maintenance and feeding of animals on the plateau. According to the data of 2020, there are a total of 1,235,552 head goats and sheep in Muş province. In the highland small ruminant husbandry towards the end of the spring, animal herds are taken to the plateaus which are cool and grassy as opposed to the drying of pastures and the start of heat. For a period of 3-5 months, sheep remain in control by shepherds in highland. After the weather cools down, highland breeders and sheep return to villages or to their settlements. Sheep herds usually consist of 300 to 500 heads. One of the most important issues to be taken into account for sustainable small ruminant husbandry in this region is no doubt the nomadic life culture. In order to get more abundant products such as milk, cheese, wool and so on, the people of the region have to go to highlands with the arrival of spring to find better grazing and water areas for animals. The results indicate that solving the problems of nomadic and semi-nomadic families is very important to sustain stockbreeding of sheep and goats, and to benefit Muş province economically.

Keywords: *Goat husbandry, Muş province, Nomadic life, Sheep husbandry Transhumance.*

COMPARISON OF EGGS FROM DIFFERENT EGG PRODUCTION SYSTEMS IN TERMS OF CAMPYLOBACTER

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Abstract

One of the most important food-related pathogens worldwide is Campylobacter. The aim of this study was to compare eggs obtained from different egg production systems in terms of *Campylobacter*. In the study, four different egg production systems were used: Conventional cage system, enriched cage system, barn system and free-range system. In the conventional system, the stocking density is set to 600 cm^2/hen. The enriched cages contain that the hens must have at least 750 cm^2 of floor space per hen, a nest, perches, and litter. In the free-range system, seven animals per square meter were housed in the indoor area. In outdoor, an area of 4 m^2 is set for each animal. In the free system, there are walking areas where animals can stay in the open area for at least 8 hours. Housing hens in non-cage alternative systems, such as free-range, floor systems, and aviary systems, allow them to express their natural behaviors with more freedom of movement. The hens were fed with 18% HP and 2800 kcal ME/kg during the experiment. In the study, there were four experimental groups, and each experimental group were formed from four replications. Twenty chickens in each replication and eighty chickens in each group were used. ATAK-S, one of our domestic hybrids, was used as animal material. *Campylobacter spp*. enumeration were made in 5 randomly taken eggs from each group for a total of 2 times, at the 34^{th} and 36^{th} weeks of the laying period. *Campylobacter* was not detected in any of the eggs obtained from all egg production systems in both periods. As a result, it is clear that there will be no problems for humans in different egg production systems in terms of *Campylobacter*.

Keywords: *Conventional cage, enriched cage, barn systems, free-range system, Campylobacter.*

MODELING OF GROWTH IN JAPANESE QUAILS CATEGORIZED BY EGG WEIGHT

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Abstract

Egg weight shows great variation in poultry, and it is known that there is a positive and strong relationship between egg weight and live weight. In this study, it was aimed to compare the hatching egg weight groups in terms of weekly body weights and Gompertz growth curve parameters in Japanese quails. A total of four egg weight groups were formed in the study. Accordingly, the eggs obtained from the breeding flock were classified according to their weight as being less than 8 g (TRT1), 8-10 g (TRT2), 10-12 g (TRT3) and heavier than 12 g (TRT4). In the study, it was determined that the weight of Japanese quails increased throughout the week, including hatching, in parallel with the increase in hatching egg weight, and the differences between the group averages in terms of egg weight were significant. Similar to weekly body weight values, differences were observed between the groups in terms of asymptotic body weight parameter of the Gompertz growth curve model and weight averages of the curve inflection point ($P<0.05$ for both traits). In terms of β_1 and β_2 parameters, the difference was found to be insignificant. As a result, it is possible to obtain faster growing and heavier birds from high weight hatching eggs.

Keywords: *Hatching eggs, Gompertz, Growth curve, Nonlinear regression, Quail.*

THE EFFECT OF DIFFERENT PLANT VEGETATION IN FREE-RANGE SYSTEM ON EGGSHELL MICROBIAL LOAD

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Abstract

The aim of this study is to investigate the effect of different plants in the free-range system on eggshell microbiology. In the study, 3 different forage plants [(Trifolium repens+ lolium perenne (A), Lotus Corniculatus+ lolium perenne (G) and Medicago sativa + lolium perenne (Y)] were planted in the out-door area. In the study, a total of 12 pens (1.5 * 2m) were made and 20 chickens were randomly placed in each pen. ATAK-S layer hybrid was used as animal material. Total aerobic mesophilic bacteria (TAMB), total coliform, *E. coli* and *Salmonella* loads were determined. A total of 24 eggs (8 egg / group) were used in the study. TAMB values were found as 5.38 log cfu / g eggs, 5.18 log cfu / g eggs and 5.35 log cfu / g eggs in the A, G, and Y groups, respectively (P>0.05). Total coliform values were found as 3.47 log cfu / g eggs, 1.48 log cfu / g eggs and 4.16 log cfu / g eggs in the A, G, and Y groups, respectively (P>0.05). *E. coli* values were found 2.47 log cfu / g eggs, 1.41 log cfu / g eggs and 2.89 log cfu / g eggs in the A, G, and Y groups, respectively (P>0.05). According to the results obtained from our study, it was seen that different plant vegetation in the out-door area did not have a significant effect on the eggshell microbial load.

Keywords: *Coliform, E. Coli, Free-range, Out-door area, Plant vegetation, TAMB.*

THE IMPACT OF BREEDING SEASON AND EGG STORAGE PERIOD ON HATCHERY PARAMETERS OF GRAND PARENT STOCK BROILER BREEDER EGGS

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Abstract

The aim of the study was to investigate the impact of breeding season and egg storage period on egg weight, egg weight loss during incubation, hatchability, chicken weight and relative chicken weight of grand parent stock broiler breeders eggs. A private commercial hatchery's data was used. A total of 1290 hatched eggs were used from grandparent stock broiler breeder at summer and winter breeding season. All eggs were stored under 55% RH and 18 °C temperature for three different egg storage periods. The groups were as follows: ≤ 6 day for egg storage -group I, 7-10 day for egg storage group – II, and 11- 16 day for egg storage- group III. The incubator conditions were 37.5°C temperature and 84% RH until 18th day, then the hatcher conditions were 36.6°C temperature and 87% RH until the chickens hatch. In the study, breeding season did not affect egg weight, hatched chicken weight and hatchability (P>0.05). But, the higher egg weight loss during incubation and the lower relative chicken weight were found in winter season eggs (P<0.01). The egg weight loss during incubation and hatchability were affected by the egg storage period (P<0.01). The interactions between the breeding season and egg storage period were found significant for the egg weight loss during incubation and relative chicken weight (P<0.01). There was significant negative correlation found between egg weight loss during incubation and hatchability at winter season eggs (r = - 0.188; P<0.01). There were significant positive correlations found between egg weight and chicken weight (r = 0.864; r = 0.892; r= 0.876) at egg storage period I, II and III of eggs, respectively (P<0.01).

Keywords: *Season, egg storage, egg weight loss, hatchability, grand parent stock broiler breeder.*

USING PROBIOTICS IN POULTRY NUTRITION: OPTIMIZING PERFORMANCE AND FEEDING COSTS

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Abstract

Poultry is one of the major animal protein sources for human nutrition. In recent years, the interest of consumers and the pressure against the use of the antibiotics in animal production have been increasing for safety and healthy foods. Due to ban of the antibiotics as growth promoters, the alternative feed additives have been suggested to improve growth rate and feed efficiency, stimulates intestinal health, and inhibit the pathogenic diseases. One of these alternatives is probiotic which is defined as live microbial that produce beneficial effects in the host animal by improving microbial balance of the intestines. Probiotics consist of living bacteria's, fungi's, yeast, and enzymes which support the gastrointestinal flora and health of digestive system. Commercial probiotic products include *Lactobacillus* spp. and *Bifidobacterium* spp. and other microorganisms (*Streptococcus thermophilus*, *Escherichia coli*, *Bacillus cereus*) and yeast (*Saccharomyces boulardii*, *Saccharomyces cerevisiae*) in poultry nutrition. There is an emerging preference for Bacillus-based probiotics in the poultry industry because this genus has characteristics that overcome the challenges associated with conventional probiotics. Their endospore forming ability enables them to be stable and viable during feed manufacturing, storage, and gut transit. The expected target of the usage of the probiotics in poultry nutrition is to maximize profitability with the lowest economical losses in production chain. The supplementation of probiotic could have potential to decrease mortality due to some infectious diseases, because it stimulates the immunity, intestinal health, and digestibility. The objective of this paper is to evaluate the beneficial effects of probiotic additives on performance parameters, nutrient digestibility, intestinal histomorphology and immunity, and the feeding cost in broiler and layer hens.

Key words: *Probiotics, bacteria, feeding cost, immune system, intestine system.*

AVIAN HERPESVIRUSES AND THEIR POTENTIAL IMPACTS ON POULTRY HEALTH

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Abstract

Herpesviruses can infect all animals and poultry. 19.8 billion eggs and 2.2 million tons of poultry meat were produced in Turkey in 2020. Due to high production capacity, avian herpesviruses (AHVs) have a significant economic and ecological impact potential on poultry health in Turkey and around the world. AHVs are group of pathogens that affect most species of domesticated and wild birds and belongs to Alphafaherpesvirinae. Gallid alphaherpesvirus-1 (GaHV-1) causes infectious laryngotracheitis (ILT). It is potentially fatal and widely recognized as one of the most contagious chicken disease. Transmission occurs through respiratory tract. ILT can affect all birds, including poultry, broilers, free-range, commercial laying hens and wild birds. ILT tends to occur more frequently in areas with heavy broiler production. Marek's disease virus (MDV) agent Gallid alphaherpesvirus-2 (GaHV-2) is highly contagious, characterized by tumors, unilateral leg paralysis and visual disturbances in poultry. Despite having a very protective vaccine, it can cause significant economic losses in laying hens. Infection transmit by respiration. Psittacid herpesvirus-1 (PsHV-1) is the agent of Pacheco's disease. It is highly contagious and affecting exotic species, particularly in parrots of high economic value. Due to high mortality rate, it is a concern of health for domestic bird markets and breeders. Most of the herpes virus infections of poultry are persistent in individuals and are ubiquitous in populations, and the viruses can be scattered for long periods after infection. Prevention and control of AHV infections mainly include improved biosecurity measures, healthy and young poultry production, coordinated rapid diagnostics, and vaccination.

Keywords: *Avian herpesviruses, Gallid alphaherpesvirus, Infectious laryngotracheitis, Mareck Disease, Pacheco Disease.*

IMPLICATIONS OF YUCCA IN REDUCING NITROGEN EXCRETION, OXIDATIVE STRESS AND IMPROVING PRODUCTION PERFORMANCE OF BROILER BIRDS

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Abstract

This study was conducted to evaluate the impacts of Yucca schidigera liquid extract supplementation in drinking water on the growth performance, blood hematological and serum biochemical parameters, excretion of nitrogen, and subsequently the level of ammonia. A total of 320 one-day old Ross 500 chickens were divided into four groups (80 chicks/group). The first control group (G1) was fed on the basal diets without any Yucca schidigera liquid extract supplementation. The 2nd, 3rd and 4th groups (G2 , G3 and G4) were fed on basal diets and Yucca schidigera liquid extract was added at the rate of 5,10 and 15ml/200L to drinking water, respectively. The chicks that received Yucca showed enhanced weight gain and better feed conversion ratio. The chickens that received Yucca showed significant decreases in litter nitrogen content, when compared to controls. The supplementation of Yucca schidigera liquid extract increased the activity of antioxidant enzymes and decreased levels of lipid peroxidation biomarkers, without a harmful effect on liver and kidney function. In conclusion, the use of natural additives is necessary to decrease nitrogen losses, feed cost, and environmental pollution, without adverse impacts on broiler performance.

Key words: *Yucca Schidigera, broiler, ammonia, Antioxidant.*

6.RURAL DEVELOPMENT AND AGROECONOMY

ANALYZE OF FACTORS AFFECTING MARKETING CHANNEL CHOICE OF SMALLHOLDER FARMERS IN AFGHANISTAN

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Abstract

This study aimed to analyze factors affecting marketing channel choice by onion smallholder farmers in the Parwan province of Afghanistan. The study used a random sampling technique for data collection, both primary and secondary sources were used. Primary data were collected through face-to-face interviews from 104 onions small-scale farmers in three main districts of Parwan province producing a high quantity of onions. Data were analyzed through descriptive statistics such as mean, standard deviation, minimum and maximum. Multinomial Logistic Regression model (MNL) was used to analyze factors affecting marketing channel choice of onion smallholder farmers in Parwan province. The result of the study revealed that farmers sold their products to three main channels, which were: brokers at farm-gate, traders, and direct sale to Kabul market. Over 60% percent of the respondents sold to brokers at farm-gate, while, the rest of the farmers sold to Kabul market and traders market channels accounted for 29.8% and 17.3% of total respondents, respectively. The multinomial logistic regression result indicated that farmers having a high level of education producing a high quantity of onion and having access to transportation facilities were more likely to sell to the Kabul market relative to the brokers' channel. Also, educated farmers producing a high quantity of onions, and having access to information and storage facility were more likely to sell to trader rather than brokers. Moreover, the probability of choosing brokers increased when farmers had another source of income and faced long distances to market.

Keywords: *Smallholder farmers, Marketing Choice, Value Chain, Afghanistan.*

DIFFUSION OF SAVING IRRIGATION TECHNOLOGIES: THE ROLE OF PUBLIC INCENTIVES AND CROP PRICES

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Abstract

Since 2000, the public authorities have aimed at encouraging the development of water-saving irrigation technologies. However, the rate of adoption of these technologies has remained low in most of these areas in Algeria. This study aims at shedding some light on the potential factors that influence saving-irrigation technology adoption in Algeria. We use a conceptual framework designed to assess the impact of public subsidies on the diffusion process of water-saving irrigation technologies. Diffusion patterns of the Drip irrigation system in the Mitidja plain (Algeria) are estimated using a sample of 136 farmers aggregated over the period 2001 to 2018. We show that equipment subsidies are the main explanatory factors of the adoption dynamics. We also show that the diffusion path is significantly affected by crop prices. These results will help to prioritize the factors that affect adoption decisions and provide insights for improving the crop and water productivity.

Key words: *irrigation, incenggives, crops.*

LOCAL HONEY GOAT MILK YOGHURT PRODUCTION. PROCESS AND QUALITY CONTROL

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Abstract

The aim of the present work is to set up a production process of goat milk-based yoghurt. To that end, six (06) kinds of yoghurt have been prepared: a mixed unflavored yoghurt with 50% cow & goat milk, a mixed flavored yoghurt with 50% cow & goat milk, an unflavored 100% goat-milk-based yoghurt, a flavored 100% goat-milk-based yoghurt, two types of 100% goat milk-based yoghurts supplemented with natural honey. The results of the bacteriological analyses of the finished products showed the total absence of pathogenic bacteria *Staphylococcus aureus* and salmonella as well as the indicator hygiene bacteria like the fecal and total coliforms. The sensory analyses results revealed that the 100% yoghurts are always better appreciated in their category (flavored or unflavored) compared to 50% mixed yoghurts. The sensory analyses results reported that the yoghurts made with honey (HGM1 and HGM2) were richer in carbohydrates (10.5g) and in energy (89.1 kilocalories) against natural yoghurts and flavored yoghurts which recorded a carbohydrate content of 5.3g and 68.3 kilocalories. The protein contents were assessed at 3.9g. Levels of lipids were at 3.5g together with amounts in minerals like calcium, phosphorous, potassium and sodium which reached respectively 168mg, 114mg, 203mg and 58mg.

Keywords: *Goat milk, Yoghurt, honey, physical chemistry, bacteriology, nutritional value, energy value.*

PHYSICOCHEMICAL AND GLUCIDS PROFILE OF MOUNTAIN HONEYS FROM SERAIDILOCALITY (NORD-EAST, ALGERIA)

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Abstract

Carbohydrate HPLC profile and physicochemical analyzes were carried out for two local honeys (*Zriba* honey ZH and *SidiAchour* honey SAH) from the municipality of Seraidiand compared to imported honeys (*San Francisco* SFH and *Elshifa* EH). The results showed that total sugar (F+G) levels of local honeys were in compliance with the standards and varied from 59.05% to 60.7% for local honeys and from 71% to 73% for imported honeys.Carbohydrate profile showed that SAH(F/G=1.52) is rich in fructose compared to that of ZH(F/G=1.35). Imported honeys showed a lower F/G ratio than local honeys, 1.13 for EHand 1.31 for SFH. The rate of sucrose in local honey was less than 1% and was 3.9% in EHand 4.3% in SFH. Maltose content in local honey was higher than sucrose, 0.6% for ZHand 0.35% for SAH. Maltose levels in both imported honeys were respectively 2.8% and 2.4% well below Saccharose levels. Four honey types (ZH, SAH, EH and SFH) showed different isomaltose levels of 1.35%, 0.95%, 1.1% and 1.2%, respectively.Trihalose was absent in imported honeys, but was identified in local honeys at rates of 0.55% and 0.7%, respectively. RegardinTrisaccharides,Erlose and raffinose were identified in all honeys exceptmelezitosis which was not identified in imported honeys. Physicochemical parameters showed that all honeys were acid with free acidity, with water content, density and a refractive index in compliance withstandards. SAH, EH and SFH had a Brix slightly higher than ZH honey, and SFH and SAH honey displayed slightly higher ash levels than standards. Overall, the results showed that the local honey's glucid profile conforms to the standards and that the honey of ZH and SAH are pure compared to the imported honey EH and SFH.

Keywords: *honey, physicochemical analysis, HPLC profile, Annaba, Algeria.*

MONITORING THE CONDITION OF AGRICALTURAL LAND AS A TOOL OF THE PRECISION FARMING SYSTEM

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Abstract

We regard agricultural land monitoring as part of the system of "precision farming", which is positioned as the future of agriculture by all the leading economies of the world. The constituent elements of the system are: technology of parallel driving and autopilot of agricultural machinery based on GPS (Global Positioning System) and GNSS (Global Navigation Satellite System) navigation systems; monitoring and assessment of the biological state of plants (construction of maps of vegetation indices) and correction of agrotechnical measures; assessment of soil condition and construction of maps of fertility, productivity and profitability of agricultural land. The most important element of monitoring territories is the use of UAVs (Unmanned Aerial Vehicle) with multispectral cameras, agricultural drones and neural network data analysis in order to form recommendations for correcting agricultural technology. Currently, OOO "Intelligent Systems of Agriculture" together with the Vitebsk State University named after P.M. Masherov, using the example of a model farm, develops a fundamental methodology for monitoring agricultural land using UAVs (DJI) (Dajiang Innovation Technology). The proposed information and analytical monitoring system includes hardware-software, natural science and legal blocks. The ultimate goal of using the system is to increase labor productivity in crop production in the north of Belarus by 10-35%. The basis of such growth is the saving of chemicals, fuel and the most accurate calculation of the place, time and volume of agrotechnical measures. In addition, the introduction of this system will increase the "environmental friendliness" of agricultural production.

Keywords: *monitoring, precision farming, agriculture, multispectral cameras, UAV.*

EXPLORING MOROCCAN OLIVE OIL CONSUMER ATTITUDE USING CONJOINT ANALYSIS

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Abstract

Morocco is considered one of the most important countries where olives are cultivated due to its climate conditions and geographical position. During centuries, Moroccan olive oil sector has played an important role in rural communities development, as a source of income and employment for a large segment of farmers. Consumption of olive oil is considered important for preserving a healthy population and eating habits keep changing over time. The current study aims to explore the Moroccan olive oil consumer behavior and to specify the best combination set by consumers based on utility scores. The data collection was conducted through face-to-face interviews with 301 households. For this end, conjoint analysis was carried out by using SPSS to evaluate the survey data. The results obtained show that the three most important olive oil factors are related to selling point, price and origin of olive oil, respectively. Furthermore, the best product quality set is extra virgin olive oil, green color, bland taste, in bulk, sold directly in the crashing unit at 5.5 Euro/lt with regional preferences. Results obtained show that consumers' preferences are changing and the consumer is much more interested in the beneficial effects provided by extra virgin olive oil. Further, due to the high quantity consumed, consumers remain faithful to the crashing unit. Consumer interest in olive oil origin is explained by the linkage to the childhood origin. This study presented meaningful implications for managers and policymakers on how to reinforce new strategies and overcome current problems to ensure future growth.

Keywords: *consumer attitude, olive oil, conjoint analysis, Morocco.*

TRACTOR SELECTION BY USING THE *FUZZY* TOPSIS METHOD OF MULTI-CRITERIA DECISION-MAKING

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Abstract

The choice of the appropriate agricultural mechanization represents an important strategic decision of every business entity in agricultural production. Therefore, the aim of this paper was to select the appropriate tractor based on ergonomic characteristics by applying the method of multi-criteria decision-making. Due to the more precise expert assessment, fazzy decision models of the TOPSIS multicriteria method were developed for his purpose. There were five alternatives available, ie five specific brands of tractors, which were selected on the basis of ten ergonomic criteria such as reliability and comfort, handling convenience, visibility, cabin noise, mechanical oscillations, microclimate, engine operation, general safety in handling and additional options. The selection of tractors based on the established criteria represented an expert assessment in the field and the selected alternatives were of almost equal categories and performances. The results of the research show that the alternative 1, ie the tractor brand John Deere 5510, is the closest to the ideal solution and as such represents the first choice of the experts in the field.

Keywords: *Multi-criteria decision-making, TOPSIS method, fazzy logic, tractors.*

RESILIENCE TO CLIMATIC INSTABILITIES IN BRAZILIAN SEMIARID RAINFED AGRICULTURE

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Abstract

This study aimed to evaluate the production of food rain fed crops: beans, cassava and corn between 1949 and 2019 in Semiarid Region of Ceará State (Brazil). It is assumed that rainfall irregularities cause instability in the productivity and economic results of these crops. The averages and standard deviations of rainfall, productivity and the value of production per hectare of crops were calculated. Rainfall was classified in periods: “Scarcity”; "Normal"; and “Excess”. The “scarcity” period (occurred in 25 years) includes rainfall below the average subtracted from half of standard deviation. The “excess” period (occurred in 19 years) incorporates years with rainfall higher than its average plus half a standard deviation. The “normal” period (observed in 26 years) is the rainfall situated in the middle position of these periods. Productivities, production values per hectare and average prices of these three food crops were aggregated in an Index using the factor analysis method by using decomposition into main components. It was tested and confirmed that these aggregate values were statistically different in the rainfall periods created in the study. To test if there were resilience in these crops after the scarcity years of rainfall, the study used dummies variables. The main conclusion showed that there was resilience in the production of these rainfed crops all over the observed series.

Keywords: *Brazilian Northeast, Family farming, Rainfall irregularities, Brazilian Semiarid Region.*

THE BULGARIAN MODEL OF LAND OWNERSHIP: THE "WHITE SPOTS" PHENOMENON

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Abstract

More than three decades after the democratic changes in Bulgaria, the reforms in land use and land ownership continue. In these transitional stages of development and reform of the institutional environment, globalization, and destructive competition, they continue to be a central topic of discussion and consultation among politicians, practitioners, analysts, researchers, and society. The paper aims to shed light on the Bulgarian model of land use and land ownership, land relations, the phenomenon of "white space" and "blurring" of property, which arose as a result of (non) application of property rights in Bulgaria. The phenomenon of "white spot" has no formal definition. This concept has become necessary over the years in practice and the possibility of turning agricultural land into a "white spot" is regulated in the Law on the ownership and use of agricultural land. Based on a regression model, the relationship between the change in the average prices of "white spots" and the average land rental prices are checked. The conclusion is that the average price of "white space" follows the change in the average rent, but with a delay that harms the owners. The phenomenon of "white space", a consequence of the "formal rules" of the institutional environment, creates conditions for "alienation" of property rights of agricultural landowners.

Keywords: *land relationships, property rights, "white space", Bulgaria.*

RURAL DEVELOPMENT IN BULGARIA – SOME ECONOMIC AND DEMOGRAPHIC ASPECTS

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Abstract

Rural development is the "second pillar" of the common agricultural policy (CAP), which strengthens the "first pillar" of income support and market measures by strengthening the social, environmental and economic sustainability of rural areas. It is extremely important for countries like Bulgaria, not only in connection with economic development, but also with demographic depopulation. Each rural development program must work to achieve at least four of the six priorities of the European Agricultural Fund for Rural Development: promoting knowledge transfer and innovation in agriculture and forestry and in rural areas; increasing the viability and competitiveness of all types of agriculture and promoting innovative agricultural technologies and sustainable forest management; promoting the organization of the food chain, animal welfare and risk management in agriculture; promoting resource efficiency and supporting the transition to a low-carbon and climate-resilient economy in agriculture, forestry and the food sector; restoration, protection and strengthening of ecosystems related to agriculture and forestry; promoting social inclusion, poverty reduction and economic development in rural areas. For the period 2021 - 2027 the projects in the Rural Development Program in Bulgaria are aimed at: organic production, disadvantaged areas, start-up aid for young farmers, support for small farms, as well as investments in farms, processing of agricultural products and non-agricultural activities. One of the biggest long-term challenges for rural development in Bulgaria is related to achieving sustainable development. Sustainable development includes solving three groups of issues: economic, related to the competitiveness of production and economic growth; ecological, aimed at preserving the natural balance; social, covering the problems of employment, education, health and the nature of governance (social equality and cohesion).

Key words: *rural development, economy, demography, Bulgaria.*

TRANSITION TOWARDS BLUE ECONOMY IN THE EUROPEAN UNION

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Abstract

Oceans cover more than two-thirds of the earth's surface and contain 97% of the planet's water. In addition to producing half of the oxygen in the atmosphere and absorbing about 25% of CO_2 emissions, they are home of vast biodiversity and a source of food, water and jobs. In recent decades, pressure on the water ecosystems have intensified as a result of climate change, excessive pollution, increasing exploitation of water resources and the inability to tackle illegal activities. This leads to an aggravation in the quality of water resources and their productivity, to an endangerment of species, to habitat destruction and to overall deterioration in the quantity and quality of all resources extracted from oceans and seas. The interconnectedness of oceans and their specific characteristics and requirements impose that the responsibility for their conservation and restoration should be shared globally. According to The European Union (EU) Blue Economy Report 2020, the directly employed in these sectors are close to 5 million people and they have generated around €750 billion in turnover and €218 billion in Gross Value Added (GVA) in 2018. This determines their great significance for the economic development of the EU. The main objective of the paper is to represent the international efforts aimed at the protection of water resources and to evaluate the measures taken to stimulate the EU transition towards blue economy through a review of available official documents, strategies, reports, plans, communications and information provided by the EU and United Nations (UN).

Keywords: *Blue Economy, Water Resources, European Union, Sustainable Development Goals.*

THE INFLUENCING FACTORS OF DAIRY FARMERS' DECISION MAKING FOR MANURE AND SEWAGE MANAGEMENT: A CASE STUDY IN CHINA

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Abstract

Due to the rapid increase of milk demands and intensive development of dairy industry, manure and sewage management (MSM) has brought considerable challenges to environmental pollutions and resource use. However, it can provide enormous opportunities to solve energy crisis and supply additional economic and social benefits, thereby promoting sustainable development of dairy industry. Therefore, the influencing factors for the appropriate selection of MSM pathways are crucial for policy-makers, especially in developing countries. This study aims to investigate the major explanatory variables that might affect the decision-making of dairy farms regarding MSM pathways. In this study, the survey data of 299 dairy farms in China were used. We adopted four key MSM pathways identified using a quantitative typology previously, including low-specialized and traditional (LTM), specialized and recycled (SRM), specialized and diversified (SDM), and semi-specified and biogas project (SBM) pathways. We used a multinomial logistic regression algorithm to estimate the potential impacts of sixteen variables on the MSM selection. To validate the accuracy, the dataset was divided into training set and test set proportionally (80% v.s. 20%). The results showed that five variables including farm construction year ($P < 0.05$), milk protein percentage ($P = 0.07$), milk sale price ($P < 0.05$), daily manure amount ($P = 0.06$), and annual total cost ($P < 0.05$) were latent important factors influencing MSM pathway selection. The prediction accuracy was 0.53. Overall, the results indicate that resource endowments, production management, and investment ability are potential factors influencing the MSM decision-making of dairy farmers.

Keywords: *Dairy farming, Manure and sewage management, Multinomial logistic regression, Influencing factor, Decision-making.*

CHANGES IN GROCERY PURCHASES IN THE NEW MILLENNIUM: THE EXAMPLE OF THE SOUTH MORAVIAN REGION IN THE CZECH REPUBLIC

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Abstract

In the Czech Republic, significant social changes took place at the turn of the millennium. One of them was the emergence of a free market. This led to the free expansion of supermarkets and shopping centers in the Czech Republic. There were dramatic changes in grocery purchases at the beginning of the millennium. This is an important and actual issue, because it affects the commuting of the inhabitants for grocery shopping, the amenities of shops in the countryside and thus the economic and social status of the countryside. The aim of the paper is to identify changes in the commuting of residents to regular purchases of daily groceries between 2005 and 2018 on the example of municipalities in the South Moravian Region (one of the NUTS 3 in the Czech Republic). On the example of the South Moravian Region (one of the NUTS 3 in the Czech Republic), centers (municipalities) were selected, where the inhabitants of individual municipalities mostly commute to make daily purchases (purchases of groceries for daily use). The spheres of influence of these centers were monitored and a time comparison of the size of the served areas took place between 2005 and 2018. A questionnaire survey was used among representatives of South Moravian municipalities (n = 382) and semi-structured interviews with selected participants (n = 21). It has been found that, since 2005, purchases of groceries for daily use have become more centralized in larger centers. On the other hand, spheres of influence have been shrinking for smaller centers since 2005. This jeopardizes smaller grocery stores and increases grocery supply chains.

Key words: *Czech Republic, South Moravian Region, retail, grocery stores, outshopping.*

INVOLVEMENT OF FARMERS IN LOCAL PARTNERSHIPS: STUDY OF LOCAL ACTION GROUPS STRUCTURE IN THE CZECH REPUBLIC

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Abstract

The contribution aims to evaluate the importance and role of farmers in 78 local action groups (LAGs) in the Czech Republic. The LAGs have gradually established themselves as important players in the EU's rural development. Therefore, it is a question of how active the farmers are in these local partnerships. Farmers represent one group of actors (non-profit organizations, municipalities, schools, non-agricultural entrepreneurs), which create the LAG. The research is based on the analysis of the created database of LAG partners (3,960 entities) (1) and the database of supported projects in LAGs in the period 2007-2013 (2). The database of LAG partners contains information on: sector of the partners, role in the LAG or localization. The database of projects supported by the LAG contains information about the applicant, the aim of the project, the focus and priority of the support. The results show that 61-70% of the partners of all LAGs are members of a private sector (including agriculture). Behind representatives of municipalities, farmers are the second most frequently represented group, as they accounted for between 12 to 23% of LAG partners. However, decision-making powers are most often held by representatives of the public sector. Supported projects (2007-2013) of LAG partners were most often implemented by the private non-profit sector (45%). Farmers, together with other entrepreneurs who were partners of the LAG, were also significantly supported (40% of projects).

Keywords: *Farmers, Local Action Group, Rural Development, Community-Led Local Development, Partnership Structure.*

TRADE EXCHANGE AND THE POSSIBILITY OF ACHIEVING FOOD SECURITY BETWEEN EGYPT AND NILE BASIN COUNTRIES

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Abstract

The research aims at studying the possibility of achieving agricultural integration between Egypt and the Nile basin countries and its role in achieving food security for these countries. The results of the study indicate that there is a food gap in most food commodity groups in the Nile basin countries, where the production capacity of the commodity groups was not able to meet the food needs. The results of the study indicate that Egypt has surplus in the crops of dry beans, green beans, potatoes, tomatoes, onions, oranges and grapes with an estimated surplus of 41.74, 27.21, 297.7, 56.23, 422.68, 851.34, 88.67 thousand tons, respectively, and the deficit in the Nile Basin countries of these crops, so trade exchange between Egypt and the basin countries should be expanded to fill the deficit. The results also indicate a deficit in Egypt of tea, coffee, sesame and bran with a deficit of 46.02, 3.73, 9.05, and 63.03 thousand tons respectively, and surplus in the basin countries. Therefore, the import of these crops and products from the basin countries should be expanded, as there is a surplus of these crops and products.

Keywords: *Trade exchange, food security, Nile Basin countries.*

CHARACTERIZATION OF COLUMBIAN COCOA BUTTER: INFLUENCE OF COMPOSITION ON STRUCTURE

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Abstract

Lipids are self-assembling molecules, responsible for compartment formation in living cells. Besides real crystals and bilayers, they also form mesophases thanks to their aptitude to modulate interface curvature. Therefore, lipid-based structures such as solid lipid nanoparticles, liposomes, cubosomes, and other hybrids are interesting for cosmetic, pharmaceutical and food applications. Those application need information about texture structure relationship in order to formulate products. Here we study the impact of the composition of Columbian cocoa butter (CB) on its structure. The main components of CB are triacylglycerols (TAG). The structure of CB, which depends on the composition of its TAGs, is relevant for chocolate manufacture as well as its use in cosmetic creams etc. The composition of CB depends on the hybrid of the plant used as well as the irrigation, temperature and fertilization of the cocoa tree. This study uses coupled analysis of thermal analysis and X-ray diffraction at small and wide angles simultaneously (DSC/SWAXS) for the monitoring of crystallization and phase transitions of CB of three different origins. The crystallization behavior of CB is monitored using a microcalix calorimeter in a lab setup. Structural changes are monitored with two independent detectors at SAXS and WAXS simultaneously with the DSC signal. Temperature is decreased from 60°C to -10°C at a rate of 4 K/min. In that manner, phase transitions can be attributed to structural changes that allow for understanding the impact of compositional changes that are important for application. The composition of TAGs is provided by a technique coupling GC/MS.

Key words: *cocoa butter, valorization, innovation, structure, food.*

THE TWO DISCREET PILLARS OF FOOD SECURITY: TRUST AND INFORMATION SHARING

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Abstract

Among the lessons learnt from the food crisis of 2007/2008 and reminded at the occasion of the covid-19, the impact of ill-informed trade policy decisions and panic stricken commercial behavior comes high on the list. As major importers of food products, especially cereals, Arab countries have a collective vested interest in working at reducing the risks of such trade shocks occurring in the future. Since 2014 the International Center for Advanced Mediterranean Agronomic Studies (CIHEAM) has been attempting through MED-Amin (MEDiterranean Agricultural Market Information Network) to build such a mechanism with the aim of preventing the storm to hit again by sharing information on cereal markets. The 13 member countries collectively decided to share information on their respective national cereal markets, taking benefit from FAO-AMIS. Among the activities carried out by the network is the elaboration of forecasted annual cereal balances, matching the available quantities with the different uses of grains adapting. The trick is to be able to predict the values of variables on both sides of the balance before the year ends in order to anticipate possible disruptions. The network has succeeded in collecting relevant data and empowering trust between its members. Now, more relevant data are public and easily accessible and countries have gained capacities in this field to predict trends and prepare for future crisis. However, it is very insufficient. Data harmonization and real-timing are two of the network challenges to be able to follow agricultural markets with an increasing unpredictability.

Keywords: *Cereals, Food security, Forecasting, Agricultural markets, Early warning.*

THE MED-AMIN HARVEST EARLY FORECAST AS A CONTRIBUTION TO FOOD SECURITY IN THE MEDITERRANEAN

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Abstract

MED-Amin network was launched in 2014. It gathers representatives of Agricultural Ministries, statistical services and Cereals Offices of the 13 CIHEAM Member States around the Mediterranean basin (Albania, Algeria, Egypt, France, Greece, Italy, Lebanon, Malta, Morocco, Portugal, Spain, Tunisia and Turkey). Since 2017, the network has developed a pilot action for monitoring crop conditions of winter cereals. This forecasting exercise, based on remote-sensing indicators and quality statistical data, aims to provide a robust indication of the shocks to be expected on future harvest at national and sub-national levels. The methodology has gained in relevance, accuracy and added-value over the years, with: the collection of baseline databases at sub-national level; a greater capacity to identify anomalies and to follow them until harvest; ready-to-use bulletins with an improved lay-out and greater feedback from the ground, which pave the way towards an Early Warning System in the Mediterranean region. Early information on harvest can help enhance countries' positioning on international markets. Current season (2020/2021) results will be discussed in view of improving information on cereal markets (production, utilization, stocks, prices, trade) and for tending to real-time transmissions of alerts in a context of vulnerability to climate change and global prices volatility. This session will demonstrate how the qualitative forecasting activity developed by MED-Amin can be beneficial (i) to the synergies between earth observation information and feedback from the ground and (ii) to food security in the Mediterranean region.

Keywords: *Food security, Remote sensing, Agricultural markets, Early warning, Mediterranean.*

STUDY OF THE TRAJECTORIES OF CHANGES IN BEEKEEPING IN A SMALL REGION OF IN BOSNIA AND HERZEGOVINA

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Abstract

This fieldwork is interesting in that it is part of a production of knowledge on the trajectories of changes in beekeeping, insofar as there is a relative lack of knowledge (for researchers/practitioners in Western Europe at least) of the forms of agriculture and beekeeping in this region. One can also defend the idea that the questions of maintenance and development of beekeeping should be read in the light of the possible evolution of the cultivation practices of farmers (but also of the actions of stockbreeders, foresters and other actors of the territory), of the conditions of access to the market, of diversification of the activities in rural areas, of the fight against poverty, but perhaps also of the commitment (or not) of the institutions and organizations (agricultural/apicultural) carrying claims in favor of new forms of agriculture and of development projects in mountain regions. The research question is twofold, (i) to produce knowledge concerning the trajectories of changes in the forms of beekeeping in the study territory (trajectories to be resituated in the evolution of the social, ecological, agricultural, economic and political context) and (ii) to put forward the elements likely to nourish the design of a serious game starting from the case studied.

Key words: *Beekeepers, Honey, Bosnia-Herzegovina, Trajectories of changes.*

BETWEEN ENVIRONMENT AND SOCIETY: IS THE KITOB-SHAHRISABZ AGRARIAN SYSTEM ABLE TO COPE WITH POPULATION GROWTH IN A CONTEXT OF UNEQUAL ACCESS TO RESOURCES?

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Abstract

The study area is Kitob-Shahrisabz. The mountain zone specializes in agro-pastoralism, the piedmont zone is active in fruit production and the alluvial basin is diversified and cotton producing. Kitob-Shahrisabz is an ancient piedmont oasis that has been practicing agriculture for centuries. The region experienced the cotton expansion of the 20th century. But, due to a strong industrial fabric for the processing of fruits and vegetables, this region has kept throughout the 20th century and until today, a specialization in the production of fruits and vegetables. In this context of unstable agrarian system, demographic growth and high land pressure, what are the current dynamics of the agrarian system? How does the Kitob-Shahrisabz society manage these inequalities of access to resources in an already highly exploited environment? The aim is to understand the resilience of the agrarian system in the face of this demographic increase. The results focus on intensification, which involves investment in labor rather than in capital. This process leads to a decrease in labor productivity and an increase in land productivity. This result is achieved in family or patronage orchards, but also in the support of dekkan crops. By giving access to land to more people, especially in access to orchards, the productivity of the land is increased. The agrarian transformation at work clearly shows the capacity of these piedmont cotton systems to evolve as proof of their resilience.

Key words: *Uzbekistan, Agrarian System, Agricultural development, trajectories.*

LEADING FACTORS OF SUSTAINABLE RURAL TOURISM DEVELOPMENT: CASE OF GEORGIA

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Abstract

The main aim of this article is to identify the leading factors for a sustainable tourism development in the rural areasfor the less developed country. Sustainable development can be defined as the process of economic and social changes where the exploitation of natural resources, the direction of investment, the orientation of scientific and technological development, personal development and institutional changes are coordinated with each other and strengthen the present and future potential for human needs and aspirations. In many ways it is about ensuring the quality of life of people. The design of the article includes theoretical explanations and empirical evidence (survey) regarding sustainability, development of proposals for legislative regulation with an aim of future tourism development with emphasis on rural areas. There are proposed more effective policies promoting the industry, in addition to specific projects improving the infrastructure and the social feelings about tourism. Several approaches have been identified, having a positive influence on the industry, regarding its direct and indirect effects on the local rural tourism destinations development. This is a first attempt on describing and identifying issues related to the Georgian rural tourism sector. It is a valuable piece of information for policy makers to adopt the article's proposals for the improvement of sustainable rural tourism development.

Keywords: *Sustainable development, Tourism, Rural Tourism, Rural destinations.*

DOING IT RIGHT TO ALLEVIATE POVERTY: APPLICATION OF THE SUSTAINABLE FOOD VALUE CHAIN DEVELOPMENT FRAMEWORK TO GHANA'S POULTRY SECTOR

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Abstract

Import of frozen chicken meat to Ghana hastremendously increased over the past two decades raising the eyebrows of some international organizations and civil society activists. These bodies are criticizing exporting countriesfor the underdevelopment of the domestic poultry sector with their cheap chicken products.However, a ban on imports may neither guarantee the supply nor affordability of domestic chicken meat and hence ensure the sustainability of the poultry value chain. Instead, it would make much sense to holistically examine Ghana's poultry sector to have a better understanding of the underlying factors limiting its ability to meet consumer demands. It is in this regard that this study was initiated to examine the performance of Ghana's poultry sector employing a wide range of quantitative and qualitative methods in the analysis .Results of the study highlight the poor economic, social, and environmental performance of the poultry sector. Besides, a weak vertical and horizontal coordination among actors in the value chain as well as low commitment from supporting stakeholders emerged as the root causes of themyriads of challenges faced. Based on the identified interlinked challenges and causes, an integrated set of economic, social, and environmental solutions are proposed to aid in developing and sustaining growth in Ghana's poultry value chain. For this, a continuous mutual cooperation is required from all actors and stakeholders in the value chain operating in transparency and trust.

Key words: *poverty, food value chain, poultry.*

BIOECONOMY IN LIVESTOCK SECTOR THROUGH BIBLIOMETRIC NETWORK ANALYSIS: A CASE FROM GREECE

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Abstract

Bioeconomy is becoming increasingly one of the most popular topics on the agenda of policy and research worldwide. Its importance has been demonstrated by the immediate strategic goals and resources that have been provided to finance its implementation at international, regional, and local levels. Our planet faces great environmental, social, and economic challenges. The livestock sector is a fundamental element of the global economy as it maintains and supports the economy of urban and marginal areas. Meanwhile, it supports human demands for food, clothing, numerous other essential products for human survival, and contributes to the recycling of nutrients, and enhances biodiversity and resource sustainability. This paper provides a thorough review of the scientific literature on the bioeconomy of livestock production. By means of bibliometric network analysis (i.e. software VOSviewer), 550 relevant documents were identified in publications between 2004 and 2021 and used in the analysis. This research visualizes the strongest links with bioeconomy with emphasis on livestock production, main research domains, most influential countries, as well as research collaborations among countries and organizations. Among the findings of this research, 5 keywords with the highest frequency during 2020 were identified. These outcomes would be useful for understanding the latest development of global research about the bioeconomy in the livestock sector and guiding future research in this subject.

Keywords: *Bioeconomy, livestock production, bibliometric analysis, VOSviewer.*

CURRENT SITUATION AND TRAINING NEEDS ON HERB SECTOR: EVIDENCE FROM GREECE, MOLDOVA, ARMENIA AND GEORGIA

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Abstract

Herbs are an integral component of the Mediterranean culture. Many farmers changed their old crops into new cultivations like herbs. This development requires investments, training programs, studies, projects in order to enrich the knowledge and skills of all the participants involved in the value chain. HEGO is a Black Sea Project, funded by the European Union and one of its main goals is the modernization of enterprises associated with cultivation, production and promotion of diversified, sustainable, value-added herb products and the enhancement of cross-border trade opportunities for local herb enterprises in participating Black Sea Basin countries (Greece, Moldova, Georgia and Armenia). During the first year of the project, Market Research survey has been performed, one in each Project country, with stakeholders from several target groups (farmers, advisors, collectors, SMEs, public authorities, organizations etc) in order to identify: (a) the current situation with reference to the collection/cultivation, processing and promotion practices used for herb products as well as legislative issues and the niche market segments for sustainable and ethical herbs products, (b) the current skills and expertise towards herbs of the participants in each country and (c) the specific future training needs of end-users of Project Outputs in relation to the above mentioned topics. The findings of these surveys provide important insights in the research field of herbs and led to conclusions, suggestions, recommendations and specific guidelines for target groups' members that will be used as feedback for the formulation of policy implementations including the development of training curricula and courses.

Keywords: *Black Sea, Extension, Herbs, Survey, Training*

A BIBLIOMETRIC NETWORK ANALYSIS ON AGRICULTURAL BIOECONOMY

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Abstract

The last decade has seen an increase in publications focusing on the bioeconomy as the solution to global challenges of climate change, exhaustion of non-renewable resources and ecosystem degradation. The present study investigates the scientific literature on agricultural bioeconomy by applying the method of bibliometric network analysis. Bibliometric analysis was applied to, the publications of the Scopus database, during the period 2010-2020 to provide an overview of the main aspects that characterize the agricultural bioeconomy. The results showed that out of a total of 1.100 scientific papers, only 2.45% were published in 2010, while the corresponding percentage in 2020 was 20.81%. In the five years 2016-2020, cumulatively 70.63% of the publications were made, showing the dynamic evolution of the bioeconomy. In addition, out of 85 countries in total, Germany and Italy are the two countries with most publications, while the fragmentation of research is evident with the creation of two main nodes, the European and the American. Moreover, keyword analysis showed that biomass and sustainability are the two main recurring concepts, confirming that, currently, bioeconomy operates at three different levels, energy demand, land demand and governance. Our pursuit is not just to present a static bioeconomy, but to use the tools of bibliometric analysis to reach more critical conclusions.

Keywords: *bioeconomy, agriculture, bibliometric analysis, sustainability, VOSviewer software.*

THE POLICY REFORMS THAT SHAPED CONTEMPORARY RURAL SOCIETY IN GREECE

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Abstract

Rural communities remain an integral part of contemporary Greek society which is active, takes actions and resists, trying to maintain its distinctive character. These are communities in a continuous endeavor to negotiate terms and manage their integration in society, very much in the way it was envisaged in the policy reforms firstly introduced in the early decades of the 20th century. The objective of this paper is to explore and highlight the importance of policies introduced by policy makers and decisions taken by Governments of Greece at that time, in order to stimulate the agricultural economy and introduce rural education in the country. The options that were available, the radical reforms implemented during the period 1910-1920, reforms that led to the social transformation of the rural sector in Greece will be analyzed and presented. Legislative decrees and laws of 1911, the educational reform that had already begun in 1913, the establishment of new ministries and the rural reform of 1917, were the result of a dynamic relationship between the rural population and the policy initiated by the Greek Government. The decisions taken and the Bills passed in the period 1910-1920 concerning agricultural economy and rural life, particularly promoted agricultural education. The primary sector in the country, although it employed a large percentage of the active Greek population and brought sizable revenues to the state treasury, had been neglected in previous decades. It is important to point out that a result of the radical reforms that occurred in the agricultural sector was the active participation of rural population in the social and economic life of the country.

Key words: *rural economy, agriculture,20th century, agricultural education.*

EFFECTIVENESS OF VILLAGE LEVEL ORGANIZATION (VLO) UNDER NATIONAL RURAL LIVELIHOOD MISSION, NAGALAND, INDIA.

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Abstract

National Rural Livelihood Mission (NRLM) is a poverty alleviation project launched in 2011 by Ministry of Rural Development, Government of India. Nagaland State Rural Livelihood Mission (NSRLM) is the implementing agency of NRLM in Nagaland State, India. NSRLM promotes Community Based Organizations (CBOs) viz., Self Help Group, Village Level Organization (VLO) and Cluster Level Federation (CLF) and this studyis on the effectiveness of VLO. As per NSRLM, a Village Level Organizations (VLOs) is an organization formed by a number of SHGs in-order to bring socio-economic changes and capacity building among the members of the groups and their respective SHGs at large. The research was conducted in Nagaland State covering three districts and two VLOs from each district whereby a total of eight respondents per VLO were interacted upon, thus making a total sample respondents of 48 respondents representing six VLOs. From the findings, it was established that, all the VLO were newly formed whereby one VLO out of six VLOs were found to be in their formation stage while majority were found to be in its normalizing stage. For measuring the effectiveness of Village Level Organizations (VLOs), the SHG Performance Measurement Tool devised by Sa-Dhan was adopted with necessary modifications. It was calculated using Frequency, Percentage, Mean and Standard Deviation.

Key words: *Performance, effectiveness, NRLM, NSRLM, Village Level Organizations.*

AGRICULTURE EXTENSION AND ADVISORY SERVICES IN BURKINA FASO AND NIGER

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Abstract

Agriculture still plays an important socio-economic role in Burkina Faso and Niger. However, the agriculture sector faces several difficulties and both countries still suffer from food insecurity and malnutrition. Therefore, there is an urgent need to develop the agricultural sector. Extension and advisory services are widely recognised as an essential instrument for agriculture development. Therefore, the present review analyses the state of research on extension and advisory services in Burkina Faso and Niger. It draws upon a search performed in June 2021 on the Web of Science. The analysis of the scholarly literature suggests a gap in the research field. The modernisation of the extension system implied the co-existence of different extension approaches, from the public training and visit (T&V) extension program to various participatory advisory approaches such as Farmer Field Schools (FFS), with different levels of involvement of the private sector and NGOs. Modern advisory services stress the centrality of farmers' participation and experiential and social learning. A prominent feature of modern advisory services is their focus on innovation development rather than the linear transfer of knowledge and technologies. The modernisation of extension services has implied an increase in ICT use. Proposals to improve advisory services performance include building extension staff's capacity, increasing funding, creating an enabling institutional environment and fostering farmers' participation. Strengthening the extension system is essential to foster the sustainable development of agriculture in Burkina Faso and Niger in the face of climate change, which, in turn, is vital to achieving sustainable food and nutrition security.

Keywords: *agriculture, rural development, extension services, training & visit, farmer field school, West Africa.*

TRANSITION TO ORGANIC AGRICULTURE IN MOROCCO

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Abstract

Agriculture is a vital sector in Morocco; it contributes 13% to the gross domestic product and employs around 30% of the total workforce and 70% in the rural areas. This puts agriculture in a sensitive spot where it affects the livelihoods of a great proportion of the population. Moroccan agricultural development programs (viz. Green Morocco Plan 2008-2019 and Green Generation 2020-2030) aim to enhance the livelihoods of farmers by focusing on the valorisation of small farms and rural areas through the development of protected geographic indications (PGI), cooperatives, and organic farming. This review paper describes the dynamics and development process of the organic agriculture niche in Morocco through the lens of the Multi-Level Perspective (MLP) on socio-technical transitions. The MLP is a widely used framework that bases its analysis on transitions being the result of the interaction of niches, socio-technical regimes, and socio-technical landscape. Niches represent novelties, regimes are the incumbent and dominant systems, and the landscape includes the external factors that affect both regimes and niches and shape their development. Results show that although the organic niche is well established (11,000 ha of organic land area in 2019), it is still developing at a slower rate than expected. While organic farming does solve many sustainability challenges that Moroccan agriculture faces, it still lacks the infrastructure and human capital to succeed as a niche. All in all, organic farming is still in the first transition stages and can follow a multitude of pathways before becoming relevant in the current agri-food system.

Keywords: *sustainability transitions, Multi-Level Perspective, agri-food system, organic farming, Morocco.*

AGROECOLOGY IN BURKINA FASO AND NIGER

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Abstract

Agroecology is considered a science, a practice and a social movement, which shows the centrality of research in agroecology development. Interest in agroecology has been shown in many developing countries such as Burkina Faso and Niger. Therefore, this paper analyses the state of research on agroecology in Burkina Faso and Niger, by drawing upon a search of scholarly publications performed in June 2021 on the Web of Science. The analysis of the scholarly literature suggests that the scientific component of agroecology is underdeveloped in both countries. Despite the recurring discourse on agroecology in West Africa, quality research is far below expectation and this might hamper the development of the agroecological movement as well as the documentation and dissemination of agroecological practices. Agroecology is presented as an instrument to address several environmental (e.g. biodiversity loss, land degradation), social (e.g. food insecurity) and economic (e.g. unemployment, poverty) challenges. Indeed, agroecology could contribute to food security, biodiversity conservation and rural livelihoods. The literature also highlights that agroecological management is knowledge-intensive so farmers' capacities need to be strengthened to increase the adoption of agroecological practices. Agroecology is also labour intensive, which can increase its contribution to local economies and livelihoods (cf. employment) but could also hamper its adoption where there is limited labour availability. Further research is needed to foster agroecological transition in Burkina Faso and Niger, which is fundamental to move towards sustainable agriculture and food systems that ensure food and nutrition security without undermining the fragile natural resource base.

Keywords: *agroecological transition, biodiversity, food security, livelihoods, West Africa.*

URBAN AND PERI-URBAN AGRICULTURE IN EGYPT

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Abstract

Around the world, urban and peri-urban agriculture (UPA) has evolved into a new socio-political manifestation that can endorse social solidarity, environmental education, and leisure activities. It is also a way to support the urban poor in middle and low-income counties and ensure food sovereignty and self-sufficiency. Furthermore, global shocks, pandemics, and crises (e.g., food crisis 2008, COVID-19, climate change) have illustrated the vulnerability of the global food supply chain, as well as the need for resilience in cities' long-term food security, shedding more light on UPA's multiple functions in densely populated areas, offering an alternative land use and greater genuine value. Considering the present worldwide governmental push to promote urban agriculture and contemplate its consequences on urban dwellers and their environs, it is vital to investigate Egypt as one of the world's most populous countries, with densely packed cities and significant poverty rates. Using a systematic literature review, this article studies the impact of UPA in Egypt. Data were gathered using the Scopus database and supplemented with information from grey literature. The findings demonstrate that UPA can perform a wide range of socio-economic and environmental roles, including aesthetic urban design, waste management, circular economy, energy use efficiency, microclimate control, preservation of cultural heritage, biodiversity conservation, and health and well-being promotion. However, there is possible apprehension concerning soil erosion, extensive use of fertilizers and pesticides, contamination from wastewater resulting from the poor implementation. Finally, while UPA can make a beneficial difference in Egypt, socio-political, cultural, and technical hurdles may stymie its growth.

Keywords: *urban agriculture, sustainability, food security, sustainable cities, Egypt.*

MEDITERRANEAN DIET IN THE WESTERN BALKANS

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Abstract

The Mediterranean diet is considered an example of sustainable diets and an intangible cultural heritage of the whole humanity. However, attention to the Mediterranean diet changes from a country to another even within the Euro-Mediterranean region. In this context, this paper analyses the state of research on the Mediterranean diet in the Western Balkans (viz. Albania, Bosnia and Herzegovina, Croatia, North Macedonia, Montenegro, Kosovo and Serbia). In particular, it explores whether and how environmental, economic, sociocultural, and nutrition-health aspects related to the sustainability of the Mediterranean diet are addressed. A search performed in June 2021 on the Web of Science returned 68 documents, and 41 of them were included in the systematic review. Most of the selected documents deals with Croatia, especially island regions, and focus on health-nutrition aspects while other sustainability dimensions are generally overlooked. The scholarly literature shows that a higher adherence to the Mediterranean diet is associated with reduced risk of obesity, different non-communicable diseases (e.g. diabetes, cardiovascular diseases, cancers, metabolic syndrome) as well as mental illnesses. However, it also highlights a decrease in the Mediterranean diet adherence even in Mediterranean/Adriatic territories. Interestingly, some recent studies showed a shift towards the Mediterranean diet during the COVID-19 lockdown even among adolescents. The analysis suggests the need to adopt a holistic approach in studies on the Mediterranean diet to better understand the relationships between the sustainability dimensions and operationalize its contribution to the transformation of food systems and the achievement of the Sustainable Development Goals in the Mediterranean region.

Keywords: *Southeast Europe, Mediterranean, Croatia, health, nutrition, sustainable diets, non-communicable diseases.*

PASTORALISM AND SUSTAINABLE DEVELOPMENT IN THE MEDITERRANEAN REGION

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Abstract

Pastoralism has a long tradition in the Mediterranean region. However, there is little evidence about its contribution to sustainable development in the region. Therefore, this review analyses the state of research on the multifaceted relations between pastoralism and sustainable development in the Mediterranean with a particular reference to the Millennium Development Goals (MDGs) and the Sustainable Development Goals (SDGs). It draws upon a systematic review of all documents indexed in the Web of Science by June 2021. The analysis of the scholarly literature suggests that (i) there is a divide with most studies performed in Northern Mediterranean countries; (ii) no article has investigated the contribution of pastoralism to the implementation of the sustainable development agendas (MDGs and SDGs) in the Mediterranean; and (iii) most of the selected articles deal with environmental sustainability (cf. biodiversity, land use, land degradation, deforestation) while social, cultural and economic aspects are generally overlooked. The ongoing processes of intensification, specialisation and modernisation of pastoral systems do not only jeopardise the provision of various ecosystem services, but also put at risk the preservation and sustainability of traditional pastoral systems. Such modernisation also leads to the erosion of pastoral culture and the abandonment of some traditional systems such as sylvo-pastoralism and mobile pastoralism. Sustainable development of pastoralism in the Mediterranean implies improving the livelihoods and living conditions of pastoralists while preserving their unique cultural heritage and social capital and ensuring the continued provision of ecosystem systems. Such development pathway should be guided by and aligned with the SDGs.

Keywords: *agro-pastoralism, biodiversity, Millennium Development Goals, pasture, Sustainable Development Goals.*

FOOD LOSSES AND WASTE DURING THE COVID-19 PANDEMIC AND HOW IT IS CHALLENGING AGRI-FOOD LOGISTICS

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Abstract

Food loss and waste (FLW) are a global phenomenon and refer to the decrease in mass (quantitative) or nutritional value (qualitative) of food. In fact, the United Nations (2015) included the issue of FLW in the Sustainable Development Goal (SDG) target 12.3. The current COVID-19 pandemic has so quickly and radically challenged agri-food logistics regarding food loss and waste (FLW) from farm to bin. The present research work postulates on the short- to longer-term implications of this public health crisis on FLW along the whole supply chain and the role of agri-food logistics. Pandemic-driven disruptions may induce intermittent food supply due to changes in work patterns, availability of food services and functioning of supply channels. This contribution outlines examples of several logistic solutions for minimising FLW as the pandemic unfolds. This contribution concludes that the pandemic and its aftermath may improve logistics skills, practices and its innovation in a manner that reduces day-to-day FLW. While COVID‑19 has opened a window of opportunity, this review indicates the potential of agri-food logistics for minimising FLW. Furthermore, this contribution advocates a rethinking of the opportunity arising from COVID-19 for the sustainable implication of appropriate logistic solutions.

Key words: *consumption and production patterns, minimising Food waste, sustainable food systems, farm to bin.*

UNDERSTANDING THE ROLE OF THE CAP IN ACHIEVING SUSTAINABILITY AND RURAL DEVELOPMENT GOALS

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Abstract

In view of the forthcoming Common Agricultural Policy (CAP) reform, it is important to add information on the results of the current CAP in relation to the objectives it tried to achieve so far. The paper endeavors to understand whether in Italy the CAP has reached the stated societal and environmental goals, with emphasis on sustainability and rural development. In order to achieve such aim, we built a set of descriptive statistics using the data set which reports information on the beneficiaries of CAP payments, in accordance with the transparency rules set by Regulation (EU) No 908/2014.The results indicate that CAP interventions in Italy have not been able to achieve all the objectives set by the Ciolos reform for correcting the weaknesses of the previous CAP. First, we found that neither the correction of the excesses of aid to large beneficiaries nor the aid redistribution towards the weaker farmers have been achieved, due to the strong asymmetry in the distribution of direct aid. Second, we found that environmental objectives, received scarce resources. Third, our results also showed the inability of the CAP in supporting small traditional farmers and maintaining a living and healthy economic and social fabric in the rural areas of the country. These results are interesting as regards the debate on the new CAP, which seems not able to overcome the old CAP shortcomings in terms of sustainability and rural development.

Key words: *Common Agricultural Policy, Sustainability, Rural Development.*

SOCIAL-DEMOGRAPHIC CHARACTERISTICS OF THE HILLY-MOUNTAINOUS AREAS IN THE REPUBLIC OF NORTH MACEDONIA

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Abstract

The hilly-mountainous areas in our country are a special socio-areal entity. Its characteristics draw their roots from the historical processes of development of the local communities and the economy in the area. Approach to these heterogeneous economical and human resources isversatile, dully noting two gradations. From one side, we have mentioned that some of the potentials have been condemned to stagnation, regression, or even complete shutdown of their existence, because of being on the line or below the critical line of the so-called economical shape of "market life". On the other hand, in these areas where centralization and concentration of the resources are above the critical line and the population structure is very unfavorable, it can be expected that with favorable social subsidies, it can keep up with the social development happening in the rest of the Republic.

Key words: *hilly-mountainous areas, demography, characteristics.*

ARGAN OIL COOPERATIVES IN THE SOUSS-MASSA REGION OF MOROCCO: A FORM OF COOPERATION LINKING PEOPLE TO THE LAND

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Abstract

The argania spinosa (scientific name of the argan tree), is a thorny tree that grows mainly in southern Morocco. For several years, products based on argan are a lever of territorial development in the area of Souss-Massa. They are sought in Morocco and abroad, and are highly valued for their food, cosmetic and medicinal. Each year, Morocco has the honor to host May 10 International Day of the argan tree which the UN has proclaimed. However, the area of the argan tree is degraded from year to year under the combined effect of population growth and overgrazing. Indeed, in less than a century, more than a third of the forest has disappeared and its average density has dropped from 100 to 30 trees per hectare. Aware of the extent of the problem, the populations concerned and the local authorities have decided to act to preserve this natural resource with a thousand virtues. Based on the principle that there can be no sustainable development without women, especially those in rural areas, several women's cooperatives have been created,the objective being to guarantee an economic, social and environmental valorization of this product of soil. Through a quantitative survey conducted among the target population, this paper aims to highlight the leading role played by Berber women in the creation of argan cooperatives, focusing on managerial practices adopted and their impact on the development of argan oil.

Keywords: *Argan oil, cooperatives, local products, territorial anchoring, social entrepreneurship.*

QUALITY OF LIFE OF RURAL HOUSEHOLDS IN NIGERIA: AN ASSESSMENT OF SPICES PRODUCERS IN KANO STATE

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Abstract

Households in rural communities of Nigeria lag behind in provision of social and infrastructural amenities that can improve their Quality of life (QoL). The study aims at ascertaining the QoL of rural residents who produce spices for their livelihood. Spices are horticultural crops with the primary purpose of enhancing the organoleptic properties of food and beverage; however, they possess inherent socio-economic qualities that can enrich livelihoods and QoL of households. Structured questionnaires were used to collect primary data from 129 spices producers in Kano state, Nigeria and the WHOQoL (2011) was used to ascertain respondents QoL. The study revealed majority (59.7 %) had more than 11 persons in their households; onions, garlic, ginger and hot pepper were largely produced in the state. Majority (55.0%) did not worry about their family's health, but 65.1% worried about their own health. While 45.0% of respondents was working under pressure, 55.8% indicated their standard of living was higher 5 years ago. Majority (87.6%) was unhappy with the quality of their children's education and 75.2% revealed that their children left school due to lack of funds. Only 20.2 % got help from spices association when in need. The study concludes that the QoL of spices producers is poor as respondents enjoyed very low level of satisfaction with key quality of life indicators. To counter this, it requires the combined effort of research institutions with the mandate to promote production and utilization of spices along with Government and Community development efforts in the provision of adequate infrastructures.

Keywords: *Spices, Rural households, Quality of life, Satisfaction, Nigeria.*

SOCIO-ECONOMIC PROFILING OF SPICES ENTREPRENEURS IN OYO STATE, NIGERIA

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Abstract

The study ascertained the socio-economic profile of rural households engaged in spices enterprises in Oyo state, Nigeria. Different types of spices entrepreneurs were discovered in the state – spices producers, gatherers and producer-gatherers. One hundred eight entrepreneurs were purposively sampled for this study. Data were collected by means of questionnaires and were analyzed using descriptive statistics. The result revealed the mean age of spices producers (PDRs), gatherers (GRRs) and producer-gatherers (PGRs) as 47.34±12.3, 49.03±9.27 and 48.75±8.38, respectively. Majority (90.0%) of PDRs, 51.4% of PGRs were male, while 90.0% of GRRs were female. Majority (71.7%) of PDRs, 88.6% of PGRs had no formal education while majority (50.0%) of GRRs had vocational education. The mean household size and annual income was 10.86±6.58, 7.03±1.60 and 6.3±2.05 and ₦146,627.48±122,926.3, ₦44,115.3±26,719.7 and ₦56, 812.5±39,287.5 by PDRs, GRRs and PGRs, respectively. The secondary occupation of majority (84.9%) of PDRs and 82.9% of PGRs was other crops farming, while that of 40.0% of GRRs was trading. Hot pepper and turmeric were cultivated by 97.6% and 62.8% of PDRs, African black pepper and Ethiopian pepper were gathered by 100.0% and 98.3% of GRRs, while hot pepper was cultivated by 100% and African Black pepper was gathered by 85.8% of PGRs. Majority (86.0%) and 83.0% of PDRs belonged to farmers group and cooperative societies, 100.0% and 95.0% of GRRs belonged to cooperative societies and religious groups, while 97.1% and 91.7% of PGRs belonged to cooperative societies and work exchange groups. The study recommends that social participation in communal activities could be used as avenue to promote spices enterprises, as respondents belonged to various social networks.

Keywords: *spices, gatherers, producer-gatherers, Oyo state, social networks.*

POTENTIALS OF IRRIGATION ALONG TELWA VALLEY IN TCHIROZERINE DEPARTMENT, AGADEZ AREA (NIGER)

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Abstract

The study focuses on the constraints and potentials of irrigation in three municipalities crossed by the Telwa valley in the department of Tchirozérine, Region of Agadez. The valley passes through the towns of Agadez, Dabaga and Tchirozérine. It is one of the Aïr valleys that carry significant amounts of rainwater collected from the Aïr Mountains. The article highlights the constraints potential of irrigation in this Telwa valley. The study involved a sample of 48 producers chosen from 12 villages in the three communes. It appears that the total areas of irrigable land are variable with an average of 1.66 ha. Likewise, the average cultivated area is 0.92 ha. The availability of irrigated land takes 47% of producers operate an area of less than 1 ha, around 31% of producers operate more than 1 ha per year. The municipalities have 46% of the irrigated sites in the region. There is an experienced human capital in irrigation management formed by 12.908 producers in 2018, including 4.427 for the three municipalities studied, which represents more than 34% of the region's workforce. Among the producers, we find both sexes but largely dominated by men 97% against 3% of women. Access to groundwater for irrigation is through two main systems, shallow PVC wells and boreholes (varying at varying depths). The dewatering is provided by motor pumps and the crops are irrigated according to the gravity and Californian type.

Keywords: *Irrigation Constraints, Potentials, Telwa valley, Borehole, PVC.*

COUNTRY LEVEL ASSESSMENT OF FOOD LOSS AND WASTE IN PAKISTAN

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Abstract

Amid looming water stress and rapid population growth, food loss and waste (FLW) are emerging concerns for Pakistan but without macrolevel understanding of the issue. Through Mass Flow Approach, we delved deeper into FLW issue and produced the first ever country level estimates of FLW based on best available secondary statistics and literature reviews. Results suggest that some 18 megatons (Mt.) or nearly 15% of all food produced in Pakistan is lost and wasted along the Food Supply Chain (FSC). Of this, the 'losses' accounted for 13.6 Mt or 11.3%, and the 'wastes' accounted for 4.32 Mt or 4.7% of the food produced in the country. Three-fourth of the food that leaks out of the FSC is loss - 14% occurring during harvest, 21% in post-harvest and handling, 18% during processing and 23% in the wholesale market. The remaining one-fourth is food waste - 18% occurring at retail market and 7% in household. The economic cost of FLW amounts to PKR 2.17 trillion or USD 20.72 billion or 7 % of the country's Gross Domestic Product in 2017. The loss estimates are equal to 35 trillion calories or 13.8 % of the total calories produced in Pakistan, besides having huge land and water footprints. Based on the review of global best practices of managing FLW to curb this hidden driver of hunger and alleviate unnecessary pressure from our food production systems, we recommend policies promoting circular economic model of food production and consumption.

Keywords: *food loss, food waste, Pakistan.*

MICROALGAE- ROLE IN DEVELOPMENT OF BIO (H_2, ETHANOL AND DIESEL) FUELS

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Abstract

Equilibrium between financial, agriculture and ecological progress could be made by using substitute fuel which should be economically inexpensive, technically feasible, readily obtainable and environmentally satisfactory. Biohydrogen, bioethanol and biodiesel obtained from biomass of renewable raw material has all the above mentioned properties. Microalgae (Chlorophytes) also known as 3rd generation biofuel producers are the photosynthetic organisms. Biodiesel is monoalkyl esters of long chain fatty acids, and several microalgal species have diverse types of lipids for production of biodiesel. Microalgae are direct ethanol secretors in the medium, also well known to produce biohydrogen. Thirty-three different microalgae isolates were obtained from different geographic regions of Pakistan. Lipids were extracted and quantified by transesterification. Light, Fluorescent and Confocal microscope was used for the observation and detection of lipids by using lipid staining dyes. FTIR analysis was also performed for the detection of lipids. Gas Chromatography was also performed for the lipids analysis. Biodiesel obtained from the isolates was also measured. Biohydrogen and bioethanol production potential of the strains was investigated under various culturing conditions (i.e., dark and light, glucose supplementation, nitrate effect). The maximum biodiesel productivity (120 mg L^{-1} day^{-1}) was observed in the *Chlorococcum* sp. SM-MFUM-16 in nitrate-less BG11 media.7.61 μm^3 lipid droplets were measured in the cells of *Gloeocystis* sp. SM-MFUM-4. Maximum biohydrogen production was obtained as 357 µmol mg Chl-a^{-1} h^{-1} by *Chlorella* sp. SM-MFUM-22.UV treated *Dunaliella* sp. SM-MFUM-41 enhanced 380% H_2 production as compared to the respective unmutated strain. Maximum bioethanol secretion was 482 mg L^{-1}acquired by *Chlorella* sp. SM-MFUM-22. Hence, the microalgal isolates showed varying ability to produce the three types of tested biofuels under different conditions.

Keywords: *Biofuels, Lipids, Microalgae, Triglycerides, Biohydrogen, Bioethanol.*

YOUNG FARMERS IN PORTUGAL: ASSESSMENT OF POLICY EFFECTS

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Abstract

This work aimed to evaluate the effects of agricultural policies, between 2005 and 2016, on the settlement of the young farmers and the changes in the Portuguese agricultural structure by age group of the farmers. The results show the ageing of agricultural holdings managers and the impossibility of generational renewal. Despite the provision of support for young farmers aiming at generational renewal, in Portugal it does not seem to have had the same effect as it has had in other countries of the European Union (EU). It is worth noting the significant decline in young farmers between 2010 and 2016, despite the new entrants supported by the rural development programme. The arising question is the relationship between young people supported by policies and young people who remained in the sector as managers of agricultural holdings. Farms run by young farmers are more profitable and market oriented. These factors increase the sector competitiveness, but they do not seem to be sufficient to keep youth in the sector. It is important to identify young people supported by agricultural policy aimed at this age group that were able to demonstrate clear business competitiveness and modernization capacity, and the public policies that promote the success of their settlement.

Keywords: *Young farmer, Agriculture, Policies, Rural Development Programme.*

FOOD WASTE MANAGEMENT ALONG THE AGRI-FOOD SUPPLY CHAIN

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Abstract

Food waste and food loss, some of the biggest issues in the world, are global phenomena that may appear along the agri-food supply chain, especially at the beginning of the supply chain in developing countries, or during the consumption in developed countries, having gigantic negative socioeconomic, food security and climate change impacts. Food waste especially addresses to the consumer (home; outside the home: restaurants, school and university canteens), and means the remove from the agri-food supply chain of foods that are still suitable for human intake. The rural and urban households are the largest generators of food waste in the food area. Food loss occurs at the beginning of the supply chain (e.g. production, post-harvest, processing), and addresses to technical and managerial impediments (e.g. lack of harvesting techniques, lack of cold-storage systems, right handling practices, poor packaging, poor sorting). Every year, all around the world, millions metric tons of foods (e.g. bakery, vegetables, root crops, fruits) are lost or wasted, and millions of humans do not have enough foods, suffering from hunger. Effectively limiting food waste is unrealistic to be changed by centering on a single intervention. This paper attempts to summarize the food waste interventions that have the potential to reduce the food waste along the supply chain, such as: smart processing technologies, improved cold-storage systems**,** IoT (Internet of Things), training of food chain actors (farmers, processors, consumers) that fits all, waste limiting campaigns (particularly in urban areas), managing resources wisely, redistribution of extra foods, and marketing.

Keywords: *Food waste, Agri-food supply chain, Management, Consumer.*

GREEN FOR CARE - STAKEHOLDER ANALYSIS IN ROMANIA

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Abstract

The Green4C (GreenForCare) project, co-funded by the Erasmus+ Programme by the European Union, is a three-year project that aims at increasing Europe's innovation capacity among universities and businesses to promote nature-based solutions for health, well-being and social inclusion. The project was conceived with the overarching aim of integrating two business and scientific sectors that were currently disconnected: the health and social inclusion sectors and the sectors related to the use of natural resources in both rural and urban areas. To support successful integration of business and scientific sectors, Green4C is proposing the development of four innovative thematic sectors: Forest-based care, Social agriculture, Urban green care and Green care tourism. The objectives of the study were to conduct a Stakeholder Analysis to identify, analyze and create an initial database of stakeholders relevant for Green4C project and to identify beneficiary training needs in social innovation and entrepreneurship. The contents of the study thus focus mainly on two types of assessment: stakeholder analysis and beneficiary training needs assessment. The stakeholder analysis was carried out to identify all possible key factors that could be interested and targeted within the project, and what sectors they operate in. These include targeted MSc and PhD courses, Green Care (and associated topics) research groups, business sectors and networks, alliances, initiatives. Green4C offers the opportunity to develop new and innovative training for emerging and future Green Care professionals. The project aims to complement a rich and varied offer in training already available from the university to the professional level integrating a set of four different thematic sectors through the development of new business models. As such, the project brings together a varied set of scientific interdisciplinary knowledge with entrepreneurial skills on the topic of nature-based solutions to health, well being and social inclusion.

Key words: *Social inclusion, Forest-based care, Social agriculture, Urban green care and Green care tourism.*

ACCESS TO PUBLIC HEALTH SERVICES FOR DIFFERENT GROUPS OF RURAL POPULATION IN RUSSIA

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Abstract

During the COVID-19 pandemic, the problems of accessibility of primary health care and quality health services for rural residents are exacerbated. The purpose of the article is to conduct comparative studies of the access to public health services of rural medical posts (RMPs), polyclinics, specialized medical facilities for different groups of the rural population of Russia. The results of the studies showed that the majority of rural residents living in small remote settlements request medical assistance at the RMPs. Among those who requested medical assistance, 70.7% were over 45 years old, and 43.9% were pensioners. Most of them have low requirements for medical assistance. They are primarily interested in the services provided for free. Younger rural residents (35.2% under the age of 45 years) request medical assistance at polyclinics, 47.8% of them are self-employed, and about 71.1% are low-income groups. The main reasons for applying for paid medical care, they call the lack of specialists in public institutions. Visitors to specialized centers have the highest requirements for the quality of medical services received. The maximum share belongs to young people (24.4% of people aged 16-30 and 20.3% aged 31-45), about 60.5% have jobs, 40.6% have incomes higher than the subsistence level. They are more likely than others to seek paid medical services. The main reason for choosing commercial institutions is the belief that paid medical services are of better quality. The construction of multidimensional distributions was performed using the statistical processing package STATISTICA Advanced for Windows 10.0.

Keywords: *public health services, access, rural population, rural development, Russia*.

INCREASING THE AGRICULTURAL PRODUCT COMPETITIVENESS AS A FACTOR IN THE AGRICULTURAL ENTERPRISE EXPORT DEVELOPMENT

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Abstract

The recent years' reforms in the sphere of the Russian agribusiness have led to an increase in agricultural production, profitability of enterprises and the development of export activities. The necessity of analyzing and substantiating the essence of the economic category of competitiveness, which is largely based on the external manifestations of the competitiveness of agricultural products, in particular the cost, has been justified. The measures to increase competitiveness at the economic level are substantiated based on the use of high-tech, nature and soil-protective agriculture and new technologies in animal husbandry and crop production in terms of the development of export potential. Some reasons have been identified that impede the development of the agricultural sector, in particular, the insufficient level of investment activity in the agricultural sector and the weakness of the economic positions of agricultural enterprises. It has been proposed to apply budgetary support to normalize their financial situation. The risks that must be taken into account when bringing agricultural products to foreign markets have been identified.

Keywords: *Agricultural enterprises, Products, Competitiveness, Export activities, Development.*

INTERNET OF THINGS IN LAND AND NATURAL RESOURCES MANAGEMENT

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Abstract

The topic of Internet of things (IoT) remains relevant for a long time, despite the fact that it began as a phenomenon in 1999 with the implementation of the corporate logistics chain management system by Mr. Kevin Ashton. The purpose of the study is to evaluate the possibilities of using the concept of IoT for sustainable development in the field of land and natural resources management. Experts have different opinions as for the prospects of the concept of IoT in the field of environmental economics; this largely explains the existence of many approaches and concepts in management theory. The use of the IoT in people's lives is quite understandable, but for the system of land and natural resources management, it is necessary to solve many interrelated tasks that have become the subject of this study. The advantages of the IoT include effective management of land and natural resources, along with such well-known intelligent systems as smart greenhouse, smart field, smart garden, smart farm, smart agriculture and others. The use of the IoT is possible in various directions - resource management in interaction with all its types, management of changes in the quality of resources, management of economic results of resource use, etc. Currently, the Ozone layer of the Earth is being destroyed due to pollution by carbon dioxide emissions including, as a result, agricultural activities. The large amount of information required for continuous monitoring of the environment provides opportunities for using the IoT in the field of managing effective resource consumption in conjunction with solving the problem of reducing industrial and household waste. The implementation of IoT projects in the field of smart agriculture can partially contribute to solving this global problem. Unfortunately, the share of such projects in the world in 2018 was only 4% compared to 23% of smart city projects. The use of technologies such as IoT in agriculture can have the greatest impact. By 2050, the world's population will reach about 10 billion people. The successful application of technologies such as IoT in agriculture can have the greatest impact on solving the global food problem in the context of industry intensification and climate change. Precision farming is one of the most well-known applications of the IoT in agriculture. Further prospects are associated with integrated land and water management systems for the transition to precision irrigation.

Keywords: *Internet of things, Environmental economics, Land management, Natural resources management.*

THE DETERMINANTS OF MICRO-AGRICULTURAL COMPANIES PROFITABILITY IN VOJVODINA PROVINCE (SERBIA)

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Abstract

The aim of this paper is to investigate the impact of determinants of profitability of micro-agricultural companies that operated in Autonomous Vojvodina Province (Serbia) in 2019 The profitability of the companies was measured through two indicators: return on assets (ROA) and return on equity (ROE). Based on the results of descriptive statistics, it was determined that the median value of ROA indicator of the observed companies was 0.49%, while the median value of ROE indicator was 3.48%. The analysis includes two models of multiple regression where ROA and ROE as the main performance determinants are defined as dependent variables. Models examine the impact of liquidity, financial leverage, debt ratio, productivity and average duration of inventory turnover on profitability of micro-agricultural companies in Vojvodina. In the first model, where return on assets appears as a dependent variable, it was noticed that of all analyzed determinants, only the dept ratio had a statistically significant impact on the profitability and that this ratio had a negative sign, ie. if the debt ratio increased, profitability would decrease. In the second model, where return on equity appears as a dependent variable, it was determined that financial leverage had a statistically significant and positive impact on the profitability, while liquidity, indebtedness and productivity had a negative and statistically significant impact on the profitability of the observed companies.

Key words: *profitability, agricultural companies, Vojvodina, performance.*

STUDING UNIQUENESS OF ACACIA HONEY FROM SERBIA – EVALUATION OF SENSORY PROPERTIES, COLOR AND TEXTURE

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Abstract

Food has always been considered as an integral part of tourism and it can play an important rolein rural tourism. Beekeeping has been recognised in many countries as a vital contributor to rural development. Honey has specific flavour highly dependent on the origin of location – local sensory uniqueness that may appeal visitors´ desire for authenticity. In order to study local uniqueness of acacia honey, sensory characteristics, colour and texture of 10 acacia honey samples produced across Serbian in 2020 were examined. All samples were collected directly from beekeepers. The results of instrumental colour and textural measurements show wide variability among analysed honey samples. The lightness (L*), redness/greenness (a*) and yellowness (b*) of samples were in the range from 45.25 to 68.66, –1.98 to 0.52, and 14.02 to 37.65, respectively. Acacia honey from Kopaonik possessed the highest lightness and the lowest yellowness. Surface stickiness and stringiness were in the range from 6.88 g to 17.96 g and from 2.38 mm to 14.83 mm, respectively. Samples from Mačvanski district possessed the lowest surface stickiness (6.88 g and 7.11 g) and stringiness (2.81 mm and 4.84 mm). By multivariate data analysis, it was found that the Serbian acacia honey samples differed in their sensory profiles and the explained variance accounted for 53.24% by the first two Principal components. Especially, odour and flavour of the samples spanned the sensory variations. Honey from Kopaonik was clearly distinguished from the other analysed samples due to recognised menthol flavour and noticeable floral and vanilla odour.

Keywords: *Acacia honey, Sensory analysis, Colour, Texture.*

TENDENCIES AND PREDICTION OF PRICES OF INDUSTRIAL CROPS IN SERBIA

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Abstract

The research in this paper deals with the prices of the most important industrial crops in Serbia – soybean, sunflower, sugarbeet, rapeseed and tobacco. The main aim of the research was to perform aquantitative analysisto determine the trends in the prices and to predict the trends for the following period. The analysis was based on the average annual prices for the period 2005-2019. The quantitative analysis was performed by using methods of descriptive statistics and the average annual rate of change to discover the trendsfor the analyzed period and to predict the trends for the following five years (2020-2024). The average annual price of soybean was 311.86 EUR/t. The price ranged between 189 and 527 EUR/t. The annual change rate of soybean price in Serbia in the analyzed period was 2.76%. The average annual price of sunflower was 264.78 EUR/t. The price ranged between 163 and 455 EUR/t. The annual change rate of sunflower price in Serbia was 2.13%. The average annual price of sugarbeet was 31.60 EUR/t. The price ranged between 24.36 and 40.31 EUR/t. The annual change rate of sugar beet price was 1.85 %. The average annual price of rapeseed was 299.58 EUR/t. The price ranged between 145 and 447 EUR/t. The annual change rate was 5.84%. The average annual price of tobacco was 1,749 EUR/t. The price ranged between 1,068 and 2,159 EUR/t. The annual change rate of tobacco price in Serbia was 3.90%.The predictions show that the expected prices for the industrial crops in 2024 in Serbia will be as follows: soybean 337, sunflower 266, sugar beet 35.33, rapeseed 425 and tobacco 2,208 EUR/t.

Keywords: *industrial crops, soybean, sunflower, sugarbeet, rapeseed, tobacco, prices prediction, Serbia.*

TENDENCIES AND PREDICTION OF GRAPE PRODUCTION CHARACTERISTICS IN SERBIA

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Abstract

The research in this paper deals with the main production characteristics of grape production in Serbia. Based on the quantitative analysis, the aim of the research was to determine the trends in the production characteristics of grapes, and to predict these movements for the following period. The production characteristicsof grapes(vineyard area, annual production and yield) were analysed for the period 2005-2019. The quantitative analysis was performed by using the methods of descriptive statistical analysis and the average annual rate of changes to determine the trends in the analyzed period and to predict the movements in the following period2020-2024. The average vineyard area in the analyzed period in Serbia was 22,173 ha;the annual change rate of the vineyard area was -1.59%. The average annual production of grapes in Serbia was 174,976t;the annual change rate was 0.64%. The average yield of grapes was 7.88t/ha;the annual change rate of the grape yield was 2.32%. According to the forecast results,it is expectedthat the vineyard area in 2024 in Serbia will be 18,917 ha, the annual production will be 168,971 t, and the grape yield will amount to 8.97 t/ha.

Keywords: *grape, production, prediction, vineyard area, grapeannual production, grape yield, Serbia.*

ANALYSIS OF THE PARTICIPATION OF INCENTIVES IN LIVESTOCK IN RELATION TO THE AGRICULTURAL BUDGET OF THE REPUBLIC OF SERBIA

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Abstract

One of the most difficult chapters in the EU accession negotiations, based on the experience of other members, is the chapter on agriculture and rural development. The agrarian budget is a joint and consolidated form of state support for agriculture, which is implemented through subsidies for agricultural production. The subject of research in this paper is the analysis of agricultural policy and formed incentive measures in various areas of agricultural production in Serbia. Also, the budget of the Republic of Serbia, the agrarian budget of the Republic of Serbia and the planned and implemented incentive measures in agriculture for the period 2016-2020 will be compared. Based on the budget of the Republic of Serbia for 2017, the funds distributed to the Ministry of Agriculture amounted to 43.8 billion rsd, which is 3.3 billion rsd more than in 2016. On the other hand, the share of the budget of the Ministry of Agriculture in the total budget of the Republic of Serbia shows a decreasing trend and in 2017 it amounted to about 4.8%. Budget funds for agriculture in 2018 amounted to 44.1 billion rsd, which is approximately the level of the previous year (0.7% more), but with the trend of decreasing the share of the budget of the Ministry of Agriculture in the total budget of the Republic of Serbia, which reaches a value of 4.46% in 2018. The financial resources determined by the agrarian budget in 2019 were lower for 0.3%, while the difference in 2020 was 3.13%, with the announced possibility of rebalance and increase of funds as in 2019. Solving the problem of financing has a direct impact on the development of agriculture, observed from the aspects of primary agricultural production, agriculture in a broader sense, multifunctional agriculture, as well as rural development.

Key words: *agrarian budget, incentives, agriculture, animal husbandry, development.*

ATTITUDES OF FARMERS FROM THE AREAS WITH NATURAL CONSTRAINTS TOWARD AGRICULTURAL AND RURAL DEVELOPMENT SUPPORT

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Abstract

Farmers and rural areas, especially those with natural constraints, face a number of challenges, such as lower yields, difficult access to markets, depopulation and devastation of the rural environment. Agricultural policy in Serbia does not provide a special measure for farmers in these areas which is opposite to the practice in the European Union. Nevertheless, farmers in Serbia can benefit from measures that have a specific treatment for farms located in the areas with natural constraints. The aim of this paper is to examine the attitudes of the farmers in the areas with natural constraints toward agricultural and rural development support in Serbia. Data collection was organized using a stratified simple random sampling and it included 371 farms. Face-to-face interviews were conducted during July-August 2018 in the mountainous area of East and South Serbia. The questionnaire contained information about socio-economic characteristics of the farms, attitudes on agricultural and rural policy and future plans. The data were analyzed using descriptive statistic method (measures of central tendency and variability). The results indicate that almost all farmers use direct payments and have enough information and experience to apply for this support. On the other hand, the research reveals a low level of application of rural development support especially for measures aimed at the improvement of the quality of life and diversification of the farm income, as well as measures for environmental improvement. Results provide information for policymakers that can be useful for creating more efficient rural development support aimed at farmers in the areas with natural constraints.

Keywords: *areas with natural constraints, subsidies, attitudes, Serbia.*

DEVELOPMENT OF IRRIGATION IN SERBIA FROM 2012 TO 2018

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Abstract

Irrigation supports a small but rapidly increasing share of Serbia's agricultural production. Analysis of 2012 Agricultural Census and 2018 Farm Structures Survey shows: Irrigated area increased from 100,000 ha to 160,000 ha while the number of irrigating farms rose from 97,000 to 186,000. Low river flows in 2012 prevented some farms from irrigating but at least 50,000 ha of the increase was new irrigated area. Irrigation is increasingly focussed on high-value crops, with an additional 30,000 ha of vegetables and 19,000 ha of fruit. Irrigation is now applied to 93 % of the vegetable area, 21 % of potatoes, 17 % of fruit and 2 % of cereals. Average areas irrigated are generally small: 0.2 ha of potatoes, 0.4 ha of vegetables, 0.6 ha of fruit and 1.5 ha of maize. Estimated irrigation water use rose from 230 million m^3 in 2012 to 426 million in 2018. Two-thirds of the increase came from groundwater, now 49 % of total supply. In general terms, small farms use groundwater to irrigate fruits and vegetables by surface and drip irrigation, whilst large farms use surface water to irrigate arable crops by surface and sprinkler irrigation. Output value per irrigated hectare is markedly lower on large farms due to their focus on low-value crops. Excluding heterogenous "other crops", it is estimated that irrigation covers 6 % of crop area and produces 16 % of output value, worth € 600 million per year.

Key words: *irrigation, Serbia.*

ECONOMIC AND FINANCIAL ASPECTS OF CABBAGE PRODUCTION IN FAMILY FARMS IN THE REPUBLIC OF SERBIA

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Abstract

Vegetable production in the Republic of Serbia is carried out on about 130,000 hectares, which is approximately 3.5% of total plant production. Succeeding the production of potatoes, tomatoes and peppers, cabbage is one of the most common vegetable crops grown in the Republic of Serbia. According to the Statistical Office of the Republic of Serbia, cabbage production is in the same group with kale and in 2019 both crops were grown on about 8,000 hectares in the Republic of Serbia, while in the analyzed period these crops were mostly grown on 11,000 hectares in 2015. The aim of this paper is to present the economic and financial aspects of cabbage production in farms in the Republic of Serbia in the period 2015 and 2019 based on data from the Statistical Office of the Republic of Serbia and the income and expenses survey on the family farms, which represent calculations based on variable costs, conducted by the Institute for the Science Application in Agriculture. The data for analysis have been collected from 90 farms, which are also a representative sample, due cabbage production is the dominant production on these farms. The paper also presents the influence of prices and yields on gross margin amounts in cabbage production through sensitivity analysis. The obtained results indicate a constant decrease in the amount of gross margins in cabbage production in the analyzed period, due to a significant variation in the selling price of cabbage. A significant influence of the price and yield on changes in gross margins in cabbage production was confirmed by the data obtained by sensitivity analysis.

Keywords: *gross margin, sensitivity analysis, cabbage, family farms, Serbia.*

PROFITABILITY OF SMALL-SIZED FARMS IN REPUBLIC OF SERBIA

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Abstract

This paper considers achieved production and economic results of small-sized farms in the Republic of Serbia. Farms with standard output value from 8,000 to 25,000 Euros were marked as small-sized. The main aim is to determinate and evaluate profitability level off arms dealing with different types of farming. Farms are divided into seven groups of farming: field crops; horticulture; vineyards and fruits; dairy production; livestock production – grazing livestock; granivores; mixed crops – livestock. The analysis was based on Farm Accountancy Data Network in 2019. Number of farms in the sample was increasing from year to year, up to 1,655 in 2019 most of them belonging to small-sized farms (802; 48.5%). Utilised agricultural area on average in small-sized farms ranged from 3.3 ha per farm (granivores) to 14.6 ha per farm (field crops). The highest labour input was recorded in horticulture (2.7 annual work units per farm), and the least in field crops (1.5 AWU per farm). Granivores production had the highest number of livestock units (23.6 LU per farm). The best economic results were noted in farms involved in horticulture production. Namely, these farms had the highest farm net value added per annual work unit (27,643€/AWU) and family farm income per family work unit (41,269€/FWU). On the other hand, the worst economic results were recorded in livestock production – grazing livestock. Farm net value added of 7,108 €/AWU and family farm income of 7,136 €/FWU in these farms were significantly lower in comparison with other types of farming.

Key words: *Farms, FADN, Serbia, farm net value added, family farm income.*

COMPARATIVE ANALYSES OF FOODSTUFF GEOGRAPHICAL INDICATIONS IN SERBIA, BIH AND MONTENEGRO

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Abstract

Aim of this paper is to evaluate foodstuff Geographical indications in Serbia, Bosnia and Herzegovina (BIH) and Montenegro. Geographical indications emerged as tool for certification of special quality foodstuff. GIs are important for preserving rural development by providing additional income to the small rural households. Despite the excellent production conditions, rich tradition in traditional products there is none of the GI' products recognized in EU and GIs has no significant role in the foodstuff production in the Western Balkans countries.Serbia, BIH and Montenegro are characterized by small farms with lack of economic power. With current farm structure in Western Balkan countries, increase in competitiveness cannot be achieved by producing high yield standard quality foodstuff, but path to competitive production is in added value products such as GI'. All three countries are rich in famous traditional foodstuff, but none of the countries have designated GI' products in EU. According to the conducted analyses Montenegro has fully harmonized legal framework with EU, while BIH is in great extent harmonized with EU Acquis. Serbia has least harmonized legal framework in accordance to EU Acquis. In order to develop GI' in analysed countries first condition is to fully harmonize GI' legal and implementational framework with EU, with aim to obtain EU GI' recognition for domestic GI' products. Only Montenegro has fully harmonized GIs with EU Acquis. Comparison and collaboration between Western Balkans countries in this area is important step and lessons learned are valuable tool for each country GI' further development.

Keywords: *Foodstuff quality schemes, Geographical indications, Protected Designation of Origin, Protected Geographical Indication, Traditional Speciality Guaranteed, Mountain products*.

CONSUMERS' PERSPECTIVES ON ONLINE SHOPPING AND FOOD SAFETY DURING THE COVID-19 PANDEMIC

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Abstract

The coronavirus disease (COVID-19) pandemic, which emerged in 2019, is a serious respiratory disease. "Stay at home", "good hygiene" and "social distance" campaigns have been launched to prevent the spread of the virus worldwide. However, these measures were not enough to prevent the devastating effect of the virus, and these new conditions affected the purchasing behavior of consumers. The study, consumers' perspectives on online shopping and food safety during the COVID-19 pandemic were determined. In the study, the sample size was calculated using the proportional sample size formula and was determined as 150. The Covid-19 epidemic has changed the consumption and purchasing attitudes of people in our country as well as in the world. With the change in purchasing behavior, there is an increase in the level of awareness about food safety. According to the results of the research, it has been determined that consumers have a positive attitude towards online shopping and will continue to shop online after the pandemic. In addition, during the pandemic period, consumers should be aware of the expiration date of the food, the hygiene of the place where they buy food, the proper storage of food at home, the reading of the content on the label, gloves, masks, aprons, etc. It has been determined that they pay attention to clothing, brand, additives, food, safety and quality standards, production date, glass packaging. Manufacturers need to pay attention to food safety.

Keywords: *COVID-19, Food Safety, Online Shopping.*

IMPACTS OF FIRST WAVE OF THE COVID-19 ON THE AGRICULTURAL PRODUCTION IN TURKEY: ASSESSING THE ROLES OF FARMERS DURING THE PANDEMIC

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Abstract

The current study provides potential expectations for the adverse effects of first wave of the COVID-19 on farmers in Turkey and also describes farmers' responses to mitigate the adverse effects pandemic on the agricultural sector. The study is based on telephone surveys with 2125 farmers in 22 provinces during April and May in 2020 in Turkey. This communication illustrates the possible implications and expected outcomes of the outbreak of coronavirus. Multistage cluster sampling was used as the sampling method in the study. Simple descriptive statistics and Likert scale averages were used to better understand smallholder farmer perceptions regarding the anticipated impacts of the pandemic. The results showed that 61.98% of smallholder farmers would not make any changes in their current agricultural production activities due to Covid-19 restrictions, while 32.14% stated that they were undecided, and another 5.88% reported they were willing to make changes. We identified contrasting responses by the agricultural production mostly driven in animal and crop production. In addition, it was determined that production costs increased in agricultural enterprises due to the excessive increase in input prices. It was also concluded that the transition of farmers from animal and crop production to other production systems would accelerate in cases. Therefore, the decisions taken by policymakers to handle pandemic direct and indirect effects can help smallholder farmers draw lessons on how to cope with input prices.

Keywords: *Agricultural production, First wave of COVID pandemic, Impact, Smallholder farmers, Turkey.*

EFFECT OF STATE SUBSIDIES GRANTED TO FARMERS FOR CERTIFIED SEEDS ON WHEAT YIELD IN TURKEY

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Abstract

In this study, the effect of the use of certified seeds on wheat yield, quality, and production cost was investigated. Study data were collected from 318 farmers. In the selection of sample villages, the purposive-sampling method was used. The yield following the use of certified seeds regarding wheat production in dry areas increased by 41.4%, and in irrigated areas by 23.8%. With this increase, $130.24 per hectare more in dry areas and $79.64 more in irrigated areas were obtained. However, it was determined that the production costs in wheat production decreased by $10.64 per hectare in dry and by $11.78 in irrigated areas. It was concluded that certified-wheat-seed support increased wheat production in dry areas more than that in irrigated areas. In addition, it was found that it contributed to the reduction of the cost of wheat production and the improvement of wheat quality.

Keywords: *agricultural policy, farmer preferences, profitability, wheat productivity*.

ASSESSING THE IMPACTS OF COVID-19 ON AGRICULTURE FROM THE PERSPECTIVE OF AGRICULTURAL ORGANIZATIONS: A CASE STUDY FROM GÜMÜŞHANE, TURKEY

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Abstract

The main purpose of this study is to determine the impact of the COVID-19 outbreak on agricultural production from the perspective of agricultural organizations in Gümüşhane province in Turkey. Agricultural organizations in the province include provincial and district agriculture directorates, agricultural credit cooperatives and the chamber of agriculture. The survey was conducted in February and March of 2021. Simple descriptive statistics were used in the analysis of the data. Agricultural change in the research area compared to the period before the COVID-19 outbreak was shown with proportional distributions. Findings show that the COVID-19 outbreak has not had a negative impact on agriculture in many ways in the study area. However, the increase in agricultural input prices during the pandemic period is the most unfavourable situation encountered. As expected during the pandemic period, the demand for crop and animal products increased. However, the supply of agricultural products did not increase at the same level as expected. Another finding from the study is that the COVID-19 outbreak has not reduced the sown area in the region. The reason why producers do not reduce their production areas despite the increase in production costs can be attributed to the increase in agricultural subsidies provided by the government during the pandemic. However, it is important for governments to work on structural reforms in order to overcome the shocks that occur in COVID-19 and similar epidemics.

Keywords: *Agricultural organizations, COVID-19, impact, production, Turkey.*

THE USING OF DIGITAL TECHNOLOGIES TO SOLVE PROBLEMS OF RURAL COMMUNITIES

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Abstract

Nowadays, with the progress observed in technological development, the way to innovation is widely open. There are virtually no restrictions to creativity and imagination. Innovation and especially technological innovations that have come from the development of ICT, namely the internet, artificial intelligence, computers to name a few, are transforming the daily environment in which we cohabit with all the biotic and abiotic objects which are present. In the biotic world, thanks to these innovations, artificial intelligence and ICT are at the service of life, and in the abiotic world, they allow us to better understand the physical and chemical factors of this ecosystem. Furthermore, whether it is the use of connected objects or digital technology in agriculture (digital farming), medicine (e-medicine), education (e-education), or in other fields, the use of such engineering might represent a significant threat. This paper will allow us to understand how digital and technological innovation have been able to provide solutions to our problems and at the same time present us with the potential danger they may represent.

Keywords: *Digital technologies, rural development, rural communities, ICT.*

THE IMPORTANCE OF RURAL EXTENSION AND ENERGY POLICIES FOR CLEAN AND MODERN ENERGY SOURCES

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Abstract

From last few decades, energy management and use have been under discussion not only because of its importance for social and economic development, but also due to its negative impacts on environment and health. First, Millennium Development Goals (MDGs) of UN, goal 7 address this issue more imperatively calling environmental sustainability for vulnerable and poor people. After that, Sustainable Development Goals (SDG) of UN takes the issue of access to energy more comprehensively. Goal 7 of SDGs stresses on ensuring access to sustainable, affordable, reliable and modern energy for all. As it is known, energy has become necessary component of social and economic development. Household energy is enabling household to improve their life standards on one hand, and on the other hand unavailability and un-affordability of clean and modern energy resources is a hindrance on the way to household development. Poor energy infrastructure, socio-economic factors, and cultural beliefs keeps rural household using traditional and dirty energy sources, which are the reason for many health and environmental problems. In this paper we will discuss the importance of extension activities and rural energy policies for energy use and adoption of clean and modern energy sources, especially regarding rural family income and education level, etc.

Key words: *rural extension, energy policies.*

LIVELIHOODS OF SMALL FARM HOUSEHOLDS IN COVID-19 PANDEMIC: A CASE STUDY IN THE RED RIVER DELTA OF VIETNAM

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Abstract

The COVID-19 pandemic has been affecting the entire food system, especially small farm households. Border closures, trade restrictions and confinement measures have been preventing farmers from accessing markets, including for buying inputs and selling their produce, and harvesting crops, thus disrupting domestic and international food supply chains and placed millions of livelihoods at risk. With more than two-thirds of the population living in rural areas, rural Vietnam is strongly affected by the COVID-19 pandemic in terms of losing jobs of many agricultural labourers, reducing income sources of small farm households due to the interruption of agricultural exported products market, and the decline of domestic market spending on food. This paper aims to provide empirical evidence about the impact of the COVID-19 pandemic on the livelihoods of small farm households in Northern Vietnam. Using data collected from sample farm households in the Red River Delta in Northern Vietnam, this paper investigates the effects of the COVID-19 pandemic on livelihoods of small farm households including livelihood resources, livelihood activities, and livelihood adaptation strategies. Results from 120 farm households show that a wide decrease in their income since the COVID-19 pandemic occurred in Vietnam, in which non-farming income dropped the most in households relying on crop production and wage-earning. Farm households relying on aquacultural productions and tourist services are the most affected by the COVID-19 pandemic when total income is reduced by more than 32 percent. For more pandemic resilient livelihoods, most of the farm households expected to receive government support in forms of financial provisions, preferential loans, market opening.

Keywords: *livelihood, small farm household, COVID-19 pandemic, Vietnam.*

7.FORESTRY AND AGRO-FORESTRY

STUDY OF THE QUALITY OF CORK OF NORTHWEST ALGERIA

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Abstract

This work is a contribution to a study of the cork quality of *Quercus suber* L. to determine a possibility of variation according to the environment factors. The study is being carried out in four cork forests in northwestern Algeria (Hafir, Zarieffet, Nesmoth and M'Sila). The quality indices obtained for each provenance show the "tree" effect and the "station" effect on the quality of the cork. Indeed, the mediocre quality indices <6.5 are dependent on trees brushed with dense and tall undergrowth and resinated with Aleppo pine (brush2). They simultaneously account for cork porosity> 6%, a volumetric density > 300 kg/m^3, low productivity (< 6.5 kg/m^2), physiological and pathogenic defects earthy cork, lignified cork wood, blown corkwood and insects galleries), and a decline index of 2.70. In stands maintained by silvicultural care and in sunny locations (brush1), the quality indices seem better > 8.5. This is a corky growth > 2.5 mm/year, a productivity > 7.5 kg.m^{-2}, a low porosity < 3%, a satisfactory volumetric density (195 kg.m^{-3}), favoring only minor growth defects (cork back, cork belly, cork with crack) and a healthy condition (1.25). The results also show the role of good forest management in improving the productive and qualitative performance of stands with economic and ecological value such as cork oak. It appears more clearly that in the absence of intervention by the silviculturist, the cork forest is a forest threatened with extinction.

Keywords: *Cork oak, northwest Algeria, scrub, quality index.*

GROWTH OF PEDUNCULATE OAK PROVENANCES ACCORDING TO ALTITUDES AND ECOLOGICAL-VEGETATION REIONIZATION OF THEIR ORIGIN

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Abstract

Pedunculate oak is valuable forest tree species, in Bosnia and Herzegovina almost extinct due to over exploitation. The study aims to determine whether there are differences in growth of Bosnian-Herzegovinian provenances according toaltitudes, and ecological-vegetation reionization of their origin, to select the best provenances for future planting to suitable habitats. The test included 28 provenances and was set up in Žepče in 2009. In 2020, the heights and root collar diameters of survived plants were measured. Data were processed according to provenances, altitudes, and ecological-vegetation reionization of provenances' origin. Analysis of variance showed statistically significant differences among provenances, altitude classes, and ecological-vegetation reionization. The highest average height had provenance Drvar (445.8 cm), and the lowest Visoko (262.3 cm). The highest average root collar diameter had provenance Živinice (10.7 cm), and the lowest Nević Polje (7.4. cm). The highest average height (389.8 cm) and root collar diameter (9.63 cm) had provenances from 100-200 m of altitude. Lower average height (311.7 cm) had provenances from 700-800 m and the lowest (7.62 cm) from 600-700 m. The highest average height (445.8 cm) and root collar diameter (10.0 cm) had provenances from the Mediterranean-Dinaric region, Sub-Mediterranean-mountainous area, and the lowest from the Mediterranean-Dinaric region, Sub-Mediterranean area, Sub-Mediterranean region without evergreen elements (284.94 cm and 7.56 cm respectively). The results can be used to select the best provenances, and the best areas and habitat conditions conditioned by altitude, for the reintroduction of pedunculate oak to suitable habitats in Bosnia and Herzegovina.

Key words: *pedunculate oak, provenance test, growth*

EFFECT OF LAND USE AND SOIL PROPERTIES ON SOIL TEMPERATURE DISTRIBUTION OF CAMBISOLS IN MOUNTAIN REGIONS

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Abstract

The aim of this study was to assess the effect of land use, location, and soil properties on the distribution and dynamics of soil temperature, the accumulated heat and the apparent thermal diffusivity of Cambisols in three mountain regions in Bulgaria. Annual distribution of the soil temperature (Ts) of Cambisols was registered under different land use (grassland, bare soil, deciduous and coniferous vegetation) during period June 2018-May 2021. Every day measurements were realized at 0, 2, 5, 10, 20, and 50 cm depths in 11 plots within the territory of the experimental stations Gabra (~920 m.), Govedartzi (~1540 m.), and Igralishte (~850 m) of the Forest Research Institute, situated in the Lozen, Rila and Maleshevska Mountains, respectively, in the South-Western part of Bulgaria. The experimental stations differ in climatic conditions and soil physical and chemical properties. Heat accumulated in 0-50 cm soil layer was assessed by the sum of Ts for the period with Ts > 5^{o}C. The heat accumulated in bare soil was the highest (4067-3544 ^{o}C), followed by the sums under grassland (3849-3453 ^{o}C) and forest (3096-3300 ^{o}C) in Gabra and Igralishte. The decrease of the accumulated heat under woodland in comparison to grassland was 18-20% in Gabra and 4-7% in Igralishte. At the higher elevation in Govedartzi the heat accumulated under grassland was 10-12% less than under woodland. The apparent thermal diffusivities (***a***) were estimated using annual amplitudes of Ts at depths 0.02 and 0.20 m. The data showed that the values of (***a)*** under grass 0.212 mm^2 s^{-1} in Gabra and 0.535 mm^2 s^{-1} in Igralishte were higher than under forest vegetation 0.061-0.133 mm^2 s^{-1} and bare soil 0.049-0.071 mm^2 s^{-1}. In Govedartzi the thermal diffusivity was higher 0.118 mm^2 s^{-1} under Norway spruce than under grassland 0.070 mm^2 s^{-1} and Scots pine 0.079 mm^2 s^{-1}.

Keywords: *Soil temperature distribution, Cambisols, Mountains, Land use, Bulgaria.*

SEED YIELD IN FOUR PEDUNCULATE OAK (*QUERCUS ROBUR* L.) PROVENANCES IN CROATIA

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Abstract

Over the last decade, the amount and periodicity of Pedunculate oak (*Quercus robur* L.) seed crops in Croatia have been disrupted, and thus the regeneration of its forests has become increasingly questionable. The aim of this study was to determine seed yield variations within and among four Pedunculate oak populations and its relation with tree crowns projection, and various methods of seed yield estimates. Research was carried out in four populations of Pedunculate oak in Croatia. Experimental plots 80×60 m in size were established in 2019. Horizontal crown projections were calculated for 25 dominant beech trees at each plot. Seed yield per tree was estimated based on seed traps, by visual scoring of seeding intensity and with drone. On a sample of twenty trees (five trees per population) total seed crops were collected by large nets covering their whole crown projections. The amount of seed yield per population was estimated as well. The length, width and mass of acorns were measured. Data were analysed to establish differences within and between populations. Relationships between seed yield and horizontal crown projection were analysed. Within this research, qualitative analyses of seed were obtained in Laboratory for seed testing at Croatian Forest Research Institute. The results showed high variability of seed yields within and between the populations according to qualitative and quantitative analyses.

Key words: *crown, genetics, Pedunculate oak, seed, seed yield.*

APPLICATION OF UNMANNED AERIAL VEHICLES IN PLANT HEALTH SURVEYS

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Abstract

Unmanned aerial vehicles (UAVs) or drones are relatively new technology with which we can inspect large areas in short period of time. Since the forest in Croatia are versatile and sometimes relatively hard to quality inspect, UAVs have shown to be helpful tool that could help us investigate large areas. Surveys founded by European Commission by 75% have been conducted by experts from Croatian forest research institute in forest areas from 2010. Currently 16 pests are being monitored in Croatian forest stands. Guidelines from European Food Safety Authority (EFSA) recommend usage of UAVs in their plant pest survey guidelines for non-European *Monochamus* species and *Polygraphus proximus*. Main usage of UAVs is in conducting surveys on *Bursaphelechus xylopohilus*, pine wood nematode, and with it associated its vector from *Monochamus* genus since the specific signs of attack of it are distinguishable. Forests are being inspected with lightweight UAV equipped with high quality RGB camera with which we can inspect up to 15 ha with one battery. Data collected with UAV is processed with software that georeferenced images, meaning that the image can be related to geographic coordinate system, and from it we can easily detect potentially infested trees with sawyer beetles (*Monochamus* sp.).

Keywords: *unmanned aerial vehicles, plant health surveys, quarantine pests, Croatia.*

INFLUENCE OF GENETIC AND ENVIRONMENTAL DIFFERENCES ON MICROPROPAGATION OF WILD CHERRY (*PRUNUS AVIUM* L.)

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Abstract

Wild cherry (*Prunus avium* L.) is an economically and ecologically very important forest tree species. It is highly rated for its valuable hardwood, but also for its fruits which are a source of food for many birds and mammals. Propagation of wild cherry with conventional propagation methods could be a very slow process impeded by difficulty of finding regular and sufficient quantities of natural seed. Micropropagation of selected elite genotypes is the fastest method for the production of quality seedlings that can be used for afforestation or the establishment of clonal seed plantations. The aim of this research was to investigate how *in vitro* propagation of wild cherry was influenced by genetic diversity and environment. Plant material consisted of axillary and terminal buds of a total nine clones of wild cherry from the clonal seed orchard in Kutina, Croatia. Explants were taken from the top of the canopy, from the bottom of the canopy, and from the north and south sides of the canopy. All samples were successfully introduced into the initial culture. The survival and development of microplantlets are monitored for one month. The results indicate differences between provenances as well as the existence of the influence of environmental differences on the success of micropropagation of wild cherry. This research will provide guidelines for better *in vitro* propagation of this important tree species.

Keywords: *Explant source, Genetic variability, In vitro propagation, Wild cherry*

INITIAL WORK ON THE BREEDING OF EUROPEAN BLACK POPLAR (*POPULUS NIGRA* L.) IN CROATIA

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Abstract

European black poplar, as one of the most significant tree species in riparian forests of Croatia, is also one of the more endangered species in the whole area of its distribution range. Hydromelioration interventions and introduction and expansion of alien species caused loss and fragmentation of suitable habitats, threatening genetic diversity of native black poplar. Therefore, we decided to initiate breeding efforts to obtain productive clones which could be used in forest cultures and plantations, without endangering gene pool of autochthonous species. The catkins were gathered in the area of Forest Administration Osijek, Forest Office Valpovo, and then were stored in the greenhouse of the Croatian Forest Research Institute. When the catkins were opened, the seeds were separated from the cottony layer by a sieve and then sowed into plastic tubs filled with sand. Sowing in the tubs was performed in two ways, in rows and randomly. Also, fraction of the seed was sown in styrofoam containers, filled with sand and peat substrate. Different methods of sowing were used to compare i.e. test their effectiveness. At the emergence of the first leaves the plants were transferred to the containers filled with a mixture of soil substrate and sand. Height and diameter growth were observed during the two vegetation period. By the end of the second growing season, ten percent of the most productive genotypes, with respect to growth rates, were selected and cuttings of plant material were made. In subsequent years, selected genotypes will be cloned and tested in plantations set up in various environmental conditions. By genetic testing and selection, we expect to identify one or more clones which productivity will be competitive to the poplar's clones currently in use. In addition to the economic importance, the results of this research will also be important for the conservation of the black poplar gene pool in the Republic of Croatia.

Keywords: *Black poplar, clones, genotype, seed, selection.*

SALT DISTRIBUTION AND POTATO RESPONSE TO IRRIGATION REGIMES UNDER VARYING MULCHING MATERIALS

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Abstract

Water scarcity and frequent drought spells are becoming critical challenges to sustainable agricultural development, especially in arid and semiarid regions. Thus, this work aims to investigate the effect of deficit irrigation and varying mulching materials on soil moisture content, salt distribution, and potato yield. The experiment consisted of three irrigation regimes (I 100%, I80%, and 60%) of crop evapotranspiration (ETc), designated as I100%, I80%, and I60% of ETc, and five mulching treatments viz. (i) without mulch (WM), (ii) poultry manure mulch (PMM), (iii) rice straw mulch (RSM), (iv) white plastic mulch (WPM), and (v) black plastic mulch (BPM), which were continued for two consecutive growing seasons. The results showed that soil salinity was affected by mulching and irrigation levels as the salt content increased from the initial soil salinity. Moreover, I60% recorded the highest salt accumulation in the soil profile for WM treatment compared to the rest of the irrigation and mulching treatments. It was also revealed that PMM remained unmatched by significantly producing the highest potato yield compared to other mulching materials. However, the average potato yield decreased by 13.83% and 29.16% in the 2016 season for I80% and I60% and by 12.95% and 30.91% in the 2017 season, respectively, in comparison to full irrigation (I100%). So, when sufficient irrigation water is available, full irrigation (I100%) and PMM treatment are recommended to achieve the maximum potato tuber yield, which has a minimum impact on increasing salinity. However, when the discharge is insufficient, deficit irrigation (I80%) and PMM treatment are recommended to conserve 20% of the irrigation water applied with a minimum reduction in tuber yield and a slight increase in soil salinity.

Keywords: *deficit irrigation; mulching; potato yield; salt distribution.*

SEEDBALL TECHNOLOGY – A POTENTIAL AFFORESTATION TOOL FOR DRY REGIONS OF THE WORLD

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Abstract

Environmental degradation due to climate change, and deforestation by humans as well as poor livestock grazing has always received attentions, but little mitigative efforts. Consequently, poor soil nutrient arising from soil exposure and reduced biodiversity are exacerbating. Increased afforestation programs particularly in the already affected dry regions of the world are necessary. Seedball technology may play an essential role. Seedball is a cheap seed-pelleting technique used to improve crop performance; it is a mixture of seeds (of pasture crops or trees), sand, loam, water, and optionally additives, depending on target preference, to enhance seedlings establishment in chemically infertile soils, or plant trees in degraded or deserted soils. This technology was successfully optimised for small-scale pearl millet (*Pennisetum glaucum*) and sorghum (*Sorghum bicolor*) production in West African Sahel; seedball has positive influence on crop seedlings performance. In Australia, evidence has shown dryland afforestation through seedball technology is achievable. Therefore, this study calls for the application of seedballs for rehabilitation of dry regions of the world. In dry regions, tress could be established through random dispersions of seedballs as soon as germination conditions are met. Mountain tops, rocky environments, chemically infertile soils, and where tree seedlings could hardly survive may be targeted. Seedball sowing by dispersion could be done few weeks to rainy seasons. Natural regeneration of ecosystems and improved biodiversity could be achieved. These, in turn, will reduce the negative impacts of climate change in harsh environments. A recommendation would be to optimize seedball nutrient content for different seed's osmotic tolerance.

Keywords: *tree planting, seed dispersion, harsh germination environment, dry lands, infertile soils.*

LONG-TERM EFFECTS OF OAK DECLINE ON SHRUB INDIVIDUAL'S OCCURRENCES IN AN HUNGARIAN OAK FOREST

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Abstract

Information about the occurrence of shrubby individual's relation with oak decline is fundamental to developing knowledge from forest stand. This paper focuses on the following questions: (1) how are the shrub's occurrences changed after oak decline? (2) Which shrubs have the highest occurring in the subplots? The mixed oak stand is located in the Bükk Mountains of Hungary. The monitoring plot (48 m × 48 m) was subdivided into 144 permanent subplots; the measured parameter was observed in the period 1972-2017. The shrub layer was divided into low (< 1.0 m in height) and high (≥ 1.0 m) layer. High shrub specimens were randomly distributed and had become more homogeneous by 2017; there was no subplot with 10 or more specimens in the last decade. In the subplots the policormon forming shrubs were present with a higher occurrence. Correlation analysis showed that occurrence of *Acer tataricum*, *Cornus mas* and *Euonymus verrucosus* in the high and *Cornus sanguinea* and *Ligustrum vulgare* in the low shrub layer changed significantly after the oak decline. High shrubs with the highest occurrence were *E. verrucosus* and *C. mas*. The most occurrent low shrub species were *E. verrucosus* and *L. vulgare*. Our results suggest that after the oak decline the most shrubs' occurrence decreased considerably and the distribution was more homogeneous.

Keywords: S*hrub community, oak decline, occurrence, subplots*.

ENGINEERING PROPERTIES OF SOAPNUT (*Sapindus emarginatus*)

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Abstract

Sapindus emarginatus Vahl is known as the "South Indian soapnut". Saponins are secondary metabolites act as biosurfactants, used in the fields of medicine, pharmaceutical and cosmetics. Manual separation of outer shell of soapnut from seeds are time consuming. Engineering properties of soapnut were studied to the know the characteristics of fruit and to design a mechanical decorticator. The moisture content of soapnut was 11.02% (d.b). The geometric mean diameter and sphericity of soapnut was 15.67±0.176 mm and 82±0.055 % respectively. The bulk density and porosity of soapnut was 383.25Kg/m^3 and 35.86% respectively. The angle of repose of soapnut was 24.77°. The coefficient of static friction was determined for four frictional surfaces namely, rubber, stainless steel, cardboard and aluminium. The coefficient of static friction of soapnut was highest for aluminium (4.52) and lowest for cardboard and stainless-steel surface (2.25). The minimum average hardness of soapnut was 20kg and the maximum average hardness was about 100kg with the displacement in the range of 6-7 mm.

Keywords: *soapnut, physical properties, frictional properties.*

ASSESSING POLLINOSIS RISK IN THE VESUVIUS NATIONAL PARK (SOUTHERN ITALY): A NOVEL APPROACH FOR INDEX OF URBAN GREEN ZONES ALLERGENICITY

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Abstract

Pollen released by urban flora is the mayor contributor to airborne allergen content, with adverse impact on human health, representing one of the main ecosystems disservices. The Vesuvius National Park (Southern Italy) has been developed on an area of 8017 ha, falling within 13 municipalities, in which 345,000 people live. Pollination events in the park may pose a threat to the health of people damaging their well-being. The objective of this work is to establish the potential allergenic value of the plant species occurring in the Vesuvius National Park, so that the allergenicity of the park can be estimated through version of novel approach for Index of Urban Green Zones Allergenicity (modIUGZA). It allows the determination of allergenicity of extended areas, by using sampling area and subsequent estimation of plant covers with Braun-Blanquet scale. Sampling areas have been defined and phytosociological surveys have been conducted to register plant species, relative covers and allergenicity potential. As a weighting factor, the surfaces of the park total area, and municipalities' areas were used. First, we obtained the results by the traditional deterministic approach. The results indicate that an allergic risk cannot be excluded for Ottaviano municipality and the whole park. Subsequently, we developed a quantitative risk assessment model for allergenic risk based on probabilistic model resulting in a more exhaustive risk assessment. There is a 5% probability that in the Vesuvius National Park, the vegetation may rise to an allergenic risk. The municipality-level probabilistic risk outcomes also reveal a certain probability of risk even for 11 municipalities. Sensitivity analysis indicates that plant height and vegetation cover mainly affect expected risk. This tool may be useful to forecast and prevent pollinosis related events on a large scale, allowing risk mitigation measure in health protection perspective.

Keywords: *Airborne pollen, Index of allergenicity, Vesuvius National park, Ecosystem disservices.*

BALANCING ECONOMY AND ENVIRONMENTAL ISSUES IN PRIVATE FORESTRY IN LATVIA

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Abstract

Forest sector is one of the corner stones of the national economy. It contributed about 20% of total Latvia's export in 2020 and represents around 5% of GDP. Today, forest coverage reached 53% of the total land area. Based on Latvian Forest Policy, nature protection requirements have to be taken in account in forest management in all forests. In addition, more than 28% of total forest area are protected areas and areas with special forest management restrictions, especially to harvesting. Rural development strategy and policies of other sectors in Latvia are closely related with the EU Forest strategy and ambitious targets to curb climate change. Also, various EU directives related to environmental issues, as well as growing demand of society for recreation services, significantly affect management tendencies of private forests, which occupy about 1/3 of total forest area and belongs to 120 000 forest owners. Data shows that about 7% of private forests have some restrictions for harvesting activities. The average forest property does not exceed 10 ha and restrictions apply to a large number of owners. Opinion poll of owners carried out in 2019 showed that compensation mechanisms was not satisfactory at the moment. The paper will describe results of opinion poll, types and area of restrictions and current compensation mechanism in details. Challenge of Forest Policy is to find proper tools and ways to change forest management behaviour of private forest owners towards public needs and environmental requirements, as well as new targets set by Green Deal.

Key words: *economy, environment, forestry, Latvia.*

QUALITY PARAMETERS EVALUATION OF SPRUCE (*PICEA ABIES*) SEEDLINGS GROWN AT OPEN-NURSERY CONDITION

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Abstract

Water regulates growth and development of woodland plants. During the dry period of a year, plants die, develop poorly and do not meet minimum quality requirements. Therefore it is relevant to determine optimal irrigation regime for a spruce (*Picea abies*) seedlings. In Lithuania, seedlings are usually planted in spring, they become stronger before dry summer period and thereby are less sensitive to lack of water. However, during some periods irrigation is necessary. The application of this method requires nursery garden equipped with irrigation system that ensures optimal irrigation regime. As experiment object we choose spruce (*Picea abies*) seedlings (2+2) and (1.5+1.5). Quality indices of spruce seedlings were estimated following the Order No. 337 of the Minister of the Environment of the Republic of Lithuania. Throughout the whole research period spruce seedlings were analyzed according to 2 basic indices, i.e. stalk height and stem thickness. During the period of observation, percentage of seedlings, which did not manage to survive in analyzed fields, was recorded. Irrigation also influenced qualitative indices of seedlings: 95% of non-irrigated seedlings planted in spring met minimum requirements, with average height of 35 cm; 99% or irrigated seedlings met minimum requirements, with average height being 44.5 cm. 35% of non-irrigated seedlings planted in summer met the requirements, with average height of 21 cm; 75% of irrigated seedlings met the requirement and average height amounted 24 cm. 100% of irrigated seedlings planted in spring and 72% of seedlings planted in summer met the root thickness requirement.

Keywords: *forest irrigation, spruce seedlings, seedling stalk height, seedling stem thickness.*

AGROFORESTRY BENEFITS NEAR THREATENED SPECIES, BROWN HARE (*LEPUS EUROPAEUS* L.)

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Abstract

Brown hare was widespread and abundant across its geographic range including Lithuania. However, since 80s the population declined four times. The growing concern regarding the status of Brown hare reflected in mass media emphasizing decrease in hunting bag. The long-term study results show overall deterioration in conservation status of local populations. The one of the main threats emerged from agricultural intensification. The disbalance in shelter-foraging conditions becomes usual in agricultural habitats. Hares find suitable feeding conditions and visibility in crops, pastures and meadows. However, in forests, are better shelter conditions. Crop diversity and presence of islands of tall grasses increase habitat value. Agroforestry as an intensive land-management system optimizes the benefits from the biological interactions created when trees and shrubs are deliberately combined with crops. Woody and herbaceous corridors are needed to protect near threatened wildlife species considering the 250 m optimal distance from the forest/coppice and 500 m in the post-harvest period while; regrettably, hare occurrence decreased up to 10-15%. Species preferences in 10-30-year-old stands with moderately developed clustered underwood should be considered. The habitat suitability model was developed highlightening habitat conditions of low, medium and high value. The number of overlapped home ranges and absence of other signs of life indicates poor-habitat quality.

Key words: *agroforestry, disbalance, brown hare, optimization.*

RESPONSE OF LIFE FORMS OF UNDERSTORY PLANTS TO CLEAR-CUT LOGGING

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Abstract

Anthropogenic disturbances of the boreal forest ecosystems are defined as important ecological processes with significant long-term influence on biogeochemical cycles and vegetation. The development of understory plants immediately after clear-cut logging was studied in Lithuanian boreal Scots pine forests. Experiments were carried out in *Vacciniosa* forest types. The mature forest stands and the clear-cutted areas were compared. We have determined the different response of Ericaceae shrubs *Vaccinium vitis-idaea*, *Vaccinium myrtillus* and *Calluna vulgaris* to changed environmental conditions after clear-cuttings. *Lycopodium annotinum* and *Goodyera repens* were defined as the most sensitive because small populations of these species disappeared in the cutted areas. Juvenile populations of *L. annotinum* most likely were destroyed after soil preparation for new forest planting. Mosses were damaged exceptionally strong, some species disappeared in the clear-cutted areas as well. Considerable decline of dwarf shrub layer confirmed the negative reaction of this dominated understory life form however, the dynamic of different vascular plants demonstrated species-specific response to changing environmental conditions. Because of rapid changes of light as well as damage of rhizomes by soil disturbances, the values of mean cover of the studied Ericaceae species decreased. Spread of *C. vulgaris* renewed through seedlings and the number of new annual and perennial light-demanding and nitrophilic herbs species was significant in both forest types in two years after cuttings. This study corroborated the importance of evaluation of understory plants before cuttings and will promote the implementation of protection of sensitive species and non-wood forest resources.

Keywords: *clear-cutting, life form, understory plants, soil.*

CHANGES IN FRUIT SIZE AND BIOCHEMICAL COMPOSITION OF VIBURNUM OPULUS FRUITS DURING RIPENING

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Abstract

Fruits of Viburnum opulus are very popular not only in folk medicine but they are also used for production of food and medicinal products. Biologically active compounds of these fruits could help in heart diseases and colds, digestive disorders and internal bleeding. In this study, the dynamic of fruit biochemical compounds during ripening and fruit size changes were determined. It was found that the average weight of one fruit increases no longer after the stage of technical maturity. The average ascorbic acid content increased during fruit ripening. The largest amounts of ascorbic acid were accumulated at the biological maturation in fruits of *V. opulus* var. *sargentii* and the clone P1, respectively, 58.4 mg/100g and 56.0 mg/100 g. Quantity of ascorbic acid ranged from 27.0 mg/100 g to 44.3 mg/100 g on average. At the stage of biological maturation, sugars and soluble solids were detected in large quantities also. The soluble solids content must be assessed with a refractometer to determine the exact harvest time. However, the highest titratable acidity was determined in unripe fruits (ripening stage I). Summarizing the performed biochemical studies of V. opulus fruits, it can be stated that amounts of biochemical compounds varied greatly during ripening. In order to determine precisely the most appropriate harvest time for V. opulus fruits, these characteristics need to be assessed. It is important to define when fruits accumulate large amounts of biologically active substances and acquires good taste also.

Keywords: *cultivar, biochemical compound, fruit, maturation.*

IMPROVEMENT OF SEED GERMINATION AND SEEDLING RESISTANCE OF BEECH (FAGUS SYLVATICA) BY GROWTH REGULATORS

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Abstract

Beech seeds are characterized by a strong exogenous and deep physiological dormancy. They need a long period of stratification, but even through stratification, seed germination is greatly extended in time. The aim of this study was to accelerate the seeds germination and improve the resistance of seedling by application of different growth regulators (gibberellic acid, capsicoside and genistifolioside). The concentration of growth regulators has been modified from 0.1% to 0.001%. The mean daily germination, mean germination time, speed of germination and total germination of seeds were evaluated. The best results of increase in daily germination (up to 18.5%) were obtained under influences of capsicoside and genistifolioside at concentration of 0.001%. Moreover, the time of total seeds germination was reduced by 20-22 days, which allowed for an earlier sowing of germinated seeds. The beneficial effect of treatment with growth regulators was also established when the germinated seeds were transferred to the soil by better adaptation and development of seedlings. The emergence rate and survival rate of beech seedlings increased 2.5-3.3 times. The use of growth regulators affected the morphometric parameters. The leaves from control seedlings were significantly smaller than in the variants with capsicoside and genistifolioside treatment – shorter by 1.7-2.9 cm and narrower by 0.3-1.3 cm. The leaves from seedlings treated with gibberellic acid were 1.5-1.9 times narrower than in the others variants. The relative chlorophyll index determined in the phase of three pairs leaves on seedlings treated with capsicoside and genistifolioside significantly exceeded the control (by 9.2-24.1 g/m^2).

Key words: *Fagus sylvatica, seed germination, seedlings adaptation, capsicoside, genistifolioside.*

NORTHERN TREELINES AS INDICATORS OF CLIMATE AND LAND USE CHANGES. A LITERATURE REVIEW

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Abstract

The alpine and arctic treelines are results of long-term processes involving adaptation to a cold climate with environmental stress, and with low soil temperatures and nutrient uptake rates. Global warming and changed land use as a result of changes in global economy and agricultural policy may interfere with the treeline changes. The global warming is expected to enhance tree growth and seed reproduction, thereby increasing treeline altitudes and latitudes. Expansion of the forested area as a result of reduced logging and grazing would also reduce the albedo and enhance global warming in treeline areas. Feedback effects caused by increased soil temperatures and related output of greenhouse gases are expected to further increase global warming and treeline advance. Global warming may influence tree growth and treeline position through increased seed viability and production, as well as increased vegetative growth, bud survival and reproduction. The first indicators of these changes are therefore often an increase in seedling density at or above treeline. On the other hand, local disturbance factors like increased risks of insect outbreaks, windthrow, grazing, anthropogenic disturbance and paludification would reduce or interfere with these changes, or even lead to a retreat of treelines. These limitations have to be taken into account when evaluating treelines as climatic indicators.

Keywords: *Treelines, temperature, land use, seed reproduction, feedbacks, human interactions, local disturbance factors.*

MULTIFUNCTIONAL LANDSCAPE AGROFORESTRY SYSTEM ENHANCED THROUGH ECOSYSTEM SERVICES AND BIODIVERSITY

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Abstract

Earth ecosystems are substantially destroying and degenerating by human land use which causes the loss of biodiversity and eventually disturbs the establishment of ecosystem services (ES). For this purpose, Agroforestry systems have been acclaimed as an environmentally friendly practice and economical approach of land management for forest landscape restoration. Agroforestry is the type of multifunctional landscape that combines production and biodiversity conservation. The system incorporates production and biodiversity conservation. Agroforestry provides four major ecological services and environmental remunerations: (1) biodiversity conservation (2) carbon sequestration (3) soil enrichment with mineral nutrients (4) air and water quality. Past and present signs clearly specifies that agroforestry, as part of a multifunctional working landscape, can be a sustainable land-use alternative that, in addition to alleviating poverty, deals with a number of ecosystem services and environmental paybacks. The concept of bio diverse agroforestry systems as an alternative production system reduces biodiversity loss and the negative impacts on ES in production areas. Agroforestry system offers up to 45% more benefits for biodiversity. A bio-diverse agroforestry system is the preeminent decision to develop biodiversity and ecosystem services ES in degraded areas where production systems created on sustainable management of natural resources. This comprehension should help to encourage agroforestry and its role as a fundamental character for a multifunctional working landscape over the globe.

Keywords: *Agroforestry, Ecosystem, Biodiversity conservation, Ecosystem services, Multifunctional landscape.*

USE OF THE TERRESTRIAL LASER SCANNER TO ESTIMATE BIOMASS PRODUCTION IN HYBRID POPLAR CROPS

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Abstract

Short rotation forestry (SRF) has become an important re-source of biomass production in temperate areas. The expansion of these crops is supported by environmental protection policies and economic considerations (wood for cellulose or biomass for energy). A precise estimation of biomass production is necessary for the sustainable planning of forest resources and for the exchange of energy in ecosystems. The use of the terrestrial laser scanner (TLS) in estimating the production of above ground wood biomass (AGWB) of short rotation forestry (SRF) brings an important technological leap among indirect methods. TLS technology is justified when destructive methods become difficult to carry out and allometric equations do not give accurate information. The purpose of this paper is to estimate the biomass productivity on tree parts in short rotation forestry with TLS technology. The result will be comparing with direct methods. Measuring the hybrid poplars crops with TLS Z+F Imager 5010 is supported by (I) higher accuracy of the estimate of biomass production in the SRF; (II) cost and time effective measurements over the biomass of tree parts and (III) new and validated allometric equations for SRF in NE Romania. Through the research protocol, the use of TLS for comparison with the gravimetric method will contribute to the development of knowledge in the field of hybrid crops.

Keywords: *Above-ground biomass (AGB), short rotation forestry (SRF), estimate of biomass production, terrestrial laser scanner (TLS).*

EVALUATION OF RELEVANT MINERAL CONTENTS OF MEDICINAL WILD-GROWN MUSHROOM *GANODERMA LUCIDUM* FROM DIFFERENT ROMANIAN AREAS

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Abstract

Edible and medicinal wild-growing mushrooms from around the world are known since ancient times being consumed for their nutritional and flavor properties. Although *Ganoderma lucidum* is well known for its health beneficial properties including immunomodulatory effects, it naturally accumulates, in addition to essential chemical elements, some potentially toxic or radioactive ones, which could have impact on the human health. The present study aimed to evaluate the mineral content, both of bioactive chemical elements and of heavy metals and radioactive elements, from the species *Ganoderma lucidum*. The study involved collecting samples from three different ecological areas in Romania, in the Transylvanian region. The mushroom species morphological characteristics were confirmed by the SEM analysis. The results on mineral content indicate the presence of macroelements (K, Mg, Ca, P, S, Cl), trace elements (Co, Cu, Mn, Mo, Ni, Se, Si, V), as well as heavy metals (Fe, Cu, Zn , Ni, As, Pb), radioactive elements (Fr, At, Po, U) and other chemical elements, at different concentrations. In the studied areas, six biominerals were found at relevant concentration, as follow: Si 0.0208 mg/kg, Ca 0.0231 mg/kg, P 0.0271 mg/kg, Mn 0.0183 mg/kg, K 0.0857 mg/kg and Fe 0.1267 mg/kg. This study showed that the investigated heavy metals and radioactive elements were identified in very small quantities in the fungus. The level of heavy metals is situated within the limits allowed by the World Health Organization. The average concentration of some heavy metals detected in *Ganoderma lucidum* is as follows: Pb 0.0019 mg/kg, Zn 0.0131 mg/kg, Fe 0.1267 mg/kg for the Sibiu area, and Mn 0.0183mg/kg for the Alba area. Hunedoara is representative for the accumulation of radioactive elements, such as Fr 0.0016 mg/kg, At 0.0144 mg/kg, Po 0.0013 mg/kg, followed by Sibiu with U 0.0027 mg / kg. Compared to other studies conducted in Romania on heavy metals in different mushrooms, the present investigation showed much lower levels. Statistically, a positive relationship was identified between the Zn, Fe, Mn and Pb content.

Key words: *wild-grown mushrooms, Romania.*

DETERMINATION OF SPRUCE (*PICEA OBOVATA* LEDEB.) TRUNK DIAMETER BASED ON STUMP DIAMETER IN DIFFERENT BOREAL CONIFEROUS FOREST CONDITIONS OF PERMSKII KRAI

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Abstract

The need to determine the volume of felled wood by stumps arises not only in the investigation of illegal logging. Sometimes tenants of forest plots meet with such a need when they do not receive the planned amount of wood after cutting down the stand. But they paid money for this wood. In this case, the diameters of the felled trees are determined by the tree stumps. Recalculation of diameters is carried out on special tables developed in the early 20th century. Studies conducted in Krasnoyarsk, Khabarovsk, Bryansk (Russia), Gomel (Belarus), showed the need to refine the data of scaling tables for local conditions. Large discrepancies between actual and tabular trees appear with the increasing diameter of the tree. In the Perm region, studies have already been conducted on the formation of the butt end of trees of the genus Pine (*Pinus*) and Poplar (*Populus*). This article discusses some results of the study of the relationship between the diameters in the butt part of the trunk and the diameter of the trunk measured at chest height of Spruce trees. The formation of the stembase of spruce (*Picea obovate* Ledeb.) was studied in 2019. Forest plots were selected in different forest types of the southern taiga (GKU "Dobrianskii forestry"). Measurement of trees was carried out in mixed spruce stands at the age of 75-100 years. The stand density of the plantings was of 0.5-0.7. Forest types are wood sorrel spruce forest (*Piceetum oxalidosum*), bilberry spruce forest (*Piceetum myrtillosum*) green-moss spruce forest (*Piceetum hylocomiosum*), wet valley spruce forest (*Piceetum filipendulosum*) and linden-spruce forest (*Piceetum mixto-dryopteridosum*). Studies have shown that trunks of spruce formed a fuller bole in the Perm region, than the established scaling tables. The formation of a butt part of spruce trunk has a similar character in such types of forest as wood sorrel spruce forest, bilberry spruce forest and linden-spruce forest. The measurement of the stump diameter should be carried out in the height range from the root collar to 10 cm above it. In this case, the generally accepted tables give the minimum error.

Key words: *illegal logging, diameter of spruce stump, forest type, southern taiga, boreal coniferous forest.*

FLORISTIC COMPOSITION COMPARISON BETWEEN AUSTRIAN PINE FORESTS OF ZLATIBOR AND KOPAONIK (SERBIA)

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Abstract

Austrian pine forests represent a significant complex of azonal foerests on serpentitines of Western and central Serbia. In this research, comparison of floristic composition was conducted between Austrian pine forests (*Erico-Pinetum nigrae* Krause 1957. in Krause & Ludwig 1957) of Zlatibor (western Serbia) and Kopaonik (central Serbia). Austrian pine stands on Kopaonik were registered on altitudes between 900-963 m, NW and SW expositions and 20-35° slopes. Austrian pine stands on Tornik (Zlatibor) occupy a narrow zone of altitudes from 1120-1145 m, varying expositions (SW, S, SE, N) and 20-35° slopes. Phytocoenological table shows great degree of similarity between studied stands, which is expected, considering that they belong to the same community. Given that studied Austrian pine forests belong to different localities, each exhibiting their own specificities, CA analysis of study stands indicates that there are significant differences between them in terms of floristic composition. Records from Kopaonik also show presence of xerophilous species that exist in difficult living conditions: *Carex humilis, Juniperus oxycedrus, Minuartia verna, Euphorbia glabriflora, Polygala supina* and others. Within records from Zlatibor, presence of species that are typical indicators of community degradation is noted: *Crataegus monogyna, Brachypodium pinnatum, Danthonia calycina*. Life forms spectrum shows that phanerophytes are somewhat more numerous on Zlatibor, which is a consequence of intense grazing, while hamephytes are more prevalent on Kopaonik, which indicates more extreme living conditions. Spectrum of floral elements exhibits most differences in terms of Mediterranean-sub-Mediterranean floral element presence. This element is significantly more present on Kopaonik than on Zlatibor, which indicates that Kopaonik is subject to sub-Mediterranean influence.

Key words: *Pinus nigra, serpentinite, Serbia, floristic similarity*.

COMPARATIVE ANALYSIS OF FLORISTIC COMPOSITION OF HUNGARIAN OAK AND TURKEY OAK FORESTS ON TWO LOCALITIES IN SERBIA

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Abstract

This paper compares floristic composition of Hungarian oak and Turkey oak forests (*Quercetum frainetto-cerridis* Rudski 1949) in the area of Pribojska Banja near Priboj (southwestern Serbia) and Lipovica near Belgrade (central Serbia). Hungarian and Turkey oak forests represent the most widespread zonal unit in Serbia on altitudes up to 600 m. This community occupies altitudes between 500-550m in Pribojska Banja, 5-40° inclinations and mostly shaded expositions. In Lipovica near Belgrade, this community is mostly registered on altitudes between 248-288 m, 0-3° inclinations and warmer expositions. Similarities as well as differences in floristic composition have been noted between research localitiesIn the area of Pribojska Banja, most represented species are *Quercus frainetto, Quercus cerris, Fragaria vesca, Helleborus odorus, Crataegus monogyna*. In the area of Lipovica most represented species, besides edificators, are *Fraxinus ornus, Galium aparine, Rosa arvensis, Carex divulsa, Potentilla micrantha*. In Priboj area, hemicryptophytes (43%) and phanerophytes (35%) are dominant life forms, while in Lipovica most prominent are phanerophytes (41%), followed by hemicryptophytes (35%), which indicates that both localities have been exposed to degradation. Regarding the spectrum of floral elements, the most commonly represented group in Pribojska Banja is sub-Mediterranean group (29%), which is a consequence of Southwestern Serbia being exposed to sub-Mediterranean influence, while in Lipovica the most dominant group is group of Central European floral elements (33%). Hungarian oak and Turkey oak community in Lipovica is of more mesophilic character, because Central European and sub-Atlantic floral elements are represented with 47%, as opposed to 33% in Pribojska Banja. Group of xerophilic sub-Mediterranean and Pontic-Cental Asian floral elements is represented with 46% in Pribojska Banja, and 32% in Lipovica. Overall, forests of Hungarian and Turkey oak on research localities are of xero-mesophilic character, coppice origin, exposed to degradation due to immediate proximity of urban habitats.

Key words: *Quercus frainetto, Quercus cerris, Serbia, floristic composition, zonal vegetation*.

TAXONOMICAL PROPERTIES OF GREEK MAPLE (*ACERHELDREICHII* ORPH.) ON JAHORINA MOUNTAIN IN BOSNIA AND HERZEGOVINA

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Abstract

Greek maple (*Acer heldreichii* Orph.) is subendemic tree species of Balkan Peninsula and tertiary relic. On Jahorina Mt (Entity of Republic of Srpska, Bosnia and Herzegovina), this species occurs on northwestern border of its global distribution. The aim of this research was to investigate taxonomical division of Greek maple on Jahorina, based on morphological markers. For taxonomical research, 20 representative, physiologicaly mature trees were chosen, and from every tree, 20 normally developed leaves were collected, which formed the basis for taxonomical analysis. Measured leaf properties were: leaf length, widths of upper, main and lower leaf lobes, peduncle length and angle between upper and main leaf lobes. Varieties and forms of Greek maple were separated according to leaf shape and dimensions. Two varieties were set apart, var. *heldreichii* and var. *macropterum*; within var. *macropterum* two forms were distinguished, f. *typicum* and f. *dissectum*. Results of taxonomical analysis were statistically processed. Considering that Greek maple is protected species in Republic of Srpska, this research possess special interest in increasing knowledge of variability and genetic diversity of this species, which will help in its preservation and protection.

Key words: *Greek maple, Acer heldreichii, endemic, taxonomy, Jahorina.*

THE CYNIPID GALL WASPS FAUNA ON PEDUNCULATE OAK IN THE SEED ORCHARD IN SREMSKA MITROVICA (SERBIA)

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Abstract

Gall wasps are insects, from the family Cynipidae, that induce galls on plants. Galls are common on trees of different oak species. This study presents investigation of cynipid gall wasps fauna of pedunculate oak in the seed orchard in Sremska Mitrovica (N 45º 00´ 21´´, E19º 36´ 52´´). The pedunculate oak seed orchard in Sremska Mitrovica was raised in the period 2000-2004 in a generative way for the mass production of genetically improved seeds for the establishment of new forests. The orchard was established at site isolated from larger pedunculate oak forest complexes. Because of this, it was interesting to investigate how many species of oak gall wasps occur in this oak seed orchard about 20 years after its establishment. Complex of pedunculate oak cynipid gall wasps were investigated during two - year period (2019 – 2020). In total, 12 cynipid gall wasp species were identified: *Andricus lignicolus* (Hartig, 1840), *Andricus hungaricus* (Hartig, 1843), *Andricus lucidus* (Hartig, 1843), *Andricus inflator* (Hartig, 1840), *Cynips quercusfolii* (Linnaeus, 1758), *Andricus kollari* (Hartig, 1843), *Andricus quercuscalicis* (Burgsdorf, 1783), *Andricus fecundatrix* (Hartig 1840), *Andricus quercustozae* (Bosc, 1792), *Neuroterus quercus baccarum* (Linnaeus, 1758), *Neuroterus numismalis* (Geoffroy in Fourcroy, 1785) and *Biorhiza pallida* (Oliver, 1791). The most frequent species were *C. quercusfolii*, *A. quercuscalicis* and *A. hungaricus.* Potentially the most harmful species in the studied seed orchad is *A. quercuscalicis* which can significantly reduce the yield of pedunculate oak seed.

Keywords: *Gall wasps, Pedunculate oak, Seed orchard.*

ANALYSIS OF THE ECOLOGICAL-CENOLOGICAL RELATION AND VITALITY OF ARTIFICIALLY RAISED STANDS OF ASH AND BLACK PINE IN PROTECTIVE FOREST IN VICINITY OF BELGRADE (SERBIA)

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Abstract

Ecological-coenological vitality of the structural construction of forest ecosystems is a priority planning concept and an extremely sustainable goal of planning when it comes to the functions of forest used in environmental protection. This is especially pronounced in forests of special and multifunctional purpose, and especially in forests in narrower urban zones. The goal and content of this research is conceived in accordance with that. By this we mean the analysis of ecological-coenological vitality of black pine and white ash in secondary habitats or, more specific, the analysis of ecological-coenological vitality of artificially raised stands of black pine and white ash in the habitat of the forest type of Hungarian and Turkey oak (*Quercetum farnetto-cerridis*) on brown soil. The results of the research showed that artificially raised stands of white ash are significantly ecologically and coenologically more vital in relation to artificially raised stands of black pine. Also, artificially raised stands of white ash show consistent ecological-coenological and production superiority and in that sense, they are more sustainable and in the planning procedure can be linked to various basic and specific purposes related to multifunctional sustainability and specific functional sustainability depending on specific needs. Consequently, white ash should be kept in this habitat in the following planning concepts, with the aim of overall ecological stability and ambient contents of this forest complex. When it comes to black pine in a habitat of forest type of Hungarian and Turkey oak (*Quercetum farnetto-cerridis*) on brown soil, it is necessary to revise the planning procedure in the following functional planning so to start the process of restitution and establishment of the structure of the primary type of forest with the ultimate goal of establishing different functional stability and vitality of the forest complex "Lipovica forest" in the narrower and wider urban zone.

Keywords: *forest type, ash, black pine, ecological vitality and adaptability, forest type habitat.*

NON-LINEAR MODELS APLICATIONS IN RADIAL GROWTH PREDICTION STUDIES, BASED ON CLIMATE SCENARIOS: GENERALIZED ADDITIVE MIXED MODEL (GAMM) APPROACH

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Abstract

Non-linear models, provide wealth of possibilities in environmental and ecological modelling. Trees during their life, provide significant deviations in radial increment. Also, radial growth provides significant oscillations and delaying effect on tree ring width (TRW) due to climate stressors thought the time. Based on unequal radial growth sensitivity, genetic limitations, and species-specific responses to surrounded environmental conditions linear relations cannot be expected as a logical approach. Following radial growth chronologies and environmental and climate oscillations, non-linear modelling provides a lot of possibilities to deeper interpreted their relations and provide better model fitted with used dendrochronology dataset. The most used non-models in dendroclimatological modeling are the Generalized Additive Mixed Model (GAMM) and the Generalized Additive Model (GAM). Both of them provide high performances, especially with indexed TRW chronologies. Smoothed function in GAMM is more flexible to data set, and non-require normal data distributions. Likewise, extreme low and high climate parameter extremes provide a negative effect on radial increment. This is extremely important to climate extremes, which will be increased in the future, following all RCP climate scenarios, and favored non-linear modeling. Overall, the non-linear approach provides state-of-the-art in dendroclimatological modeling, which better fitted with all radial growth deviations and their answers to climate and environmental oscillations. Hence, GAMM and GAM in almost all cases should be recognized as an suitable alternative to linear modeling.

Keywords: *Generalized Additive Model; Dendroclimatology; Radial growth; Climate change; Climate scenarios.*

Acknowledgements: This research was supported by the Science Fund of the Republic of Serbia, PROMIS, #6066697, TreeVita.

EUGLEY SOIL OF FLOODPLAIN AND PROTECTED PART OF ALUVIAL PLANE AND POSSIBILITIES OF THEIR FORESTATION

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Abstract

The paper presents the properties of eugley soil in the floodplain and embankment protected part of the alluvial plain. The floodplain is under the influence of flood and groundwater, while the protected part is exclusively under the influence of groundwater. The properties of the soil in the examined parts differ depending on the method of wetting. Eugley floodplain soil is characterized by lighter granulometric composition and the texture classes of these soils are sand and loamy sand, while the protected part soil is heavier granulometric composition with texture classes: sandy loam, clay loam, sand, loamy sand and sandy loam. In the case of soil in the flood zone, the reduction sub-horizon of gley is located at a smaller depth, i.e. 30 to 35 cm, and in the protected zone it is deeper, and we find it at a depth of 45 to 90 cm. The reaction of the soil of the floodplain is neutral to slightly alkaline, while in the soil in the protected zone is moderately alkaline. The capacity of the humus horizon of the flood zone is lower and is 10 cm, with humus content up to 3.01% in the surface horizon, while the protected part had the more powerful humus horizon with depth, from 45 to 50 cm and higher humus content ranging up to 5.59 %. The examined eugley of the soil according to the depth of the gley horizon in the area of the flood zone is classified as α-gley, and in the area of the protected zone into β-gley and γ-gley. Due to the high level of groundwater and the small depth of the gley horizon, eugley soils in the floodplain are not suitable for raising forest plantations, while eugley soils in the protected zone are suitable habitats for raising white willow plantations due to the greater depth of the gley horizon.

Keywords: *Eugley, Alluvial plain, Flooding, Groundwater, Afforestation.*

COMPARISON OF THE GROUND VEGETATION IN DOUGLAS-FIR ARTIFFICIALY ESTABLISHED STANDS AND NATURAL MIXED BEECH AND SESSILE OAK FOREST IN THE AREA OF KOSMAJ (SERBIA)

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Abstract

The paper presents a study of changes in ground vegetation associated with the conversion of natural, mixed beech-sessile oak forest (*Querco petraeae – Fagetum moesiacae* Glišić 1971.) into artificially established stands of Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco) in the area of Kosmaj (Serbia). The study has revealed that there are differences in the floristic composition because the process of artificial stand establishment entails disappearance of some species and the appearance of new ones. The introduction of Douglas-fir increases the plant species diversity. The values determined for beech-sessile oak forest have been as follows: average number of species 22; average Shannon-Wiener index 2.32; average equality index 0.74. The values of the same indicators for artificially established stands of Douglas-fir have been: average number of species 38; average Shannon-Wiener index 2.80; average equality index 0.75. In the spectrum of floral elements, plants of the Central European range type are most represented, amounting to 49% (beech-sessile oak forest) or 59% (Douglas-fir plantations). The study of the plant life forms shows that phanerophytes are the dominant class with 41% (beech-sessile oak forest) or 46% (Douglas-fir plantations). Comparative analysis of ecological indices for plant species shows a higher percentage of plants of mesotrophic and eutrophic character in artificially established stands of Douglas-fir, which indicates a higher nutrient availability

Keywords: *Douglas-fir, beech-sessile oak forest, plant species diversity, Kosmaj*.

WATER SUPPLY EFFECT ON PHYSIOLOGICAL STATUS OF MANAGED AND UNMANAGED PEDUNCULATA OAK (*QUERCUS ROBUR* L.) STANDS IN RELATION TO RIVERBED DISTANCE

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Abstract

The influence of the Sava River water supply on photosynthetic responses, pre-dawn water potential (PWP) and antioxidant activity of adult pedunculate oak (*Quercus robur* L.) trees was assessed in managed and unmanaged stands (e.g. forest reserve), located at different distances from the riverbed, within single forest complex. Responses were measured during the first evidence of drought in high growing season. Response between microsites was evident and followed the distance from the riverbed. The highest assimilation rate (A_{max}) was measured in all light intensities on site closest to the river and smallest on the site which was most distant to the water source. No significant difference between compensation points (Ic) were confirmed for the managed tree-groups (19-24 μmol/m^2s), while the forest reserve trees indicated slightly higher, but non-significantly different values (37μmol/m^2s).Values of PWP followed the same pattern as the assimilation response and indicated smaller dispersion in both forest reserve and group of trees that was closest to the river. The forest stand located farthest from the river was exposed to the negative influence of oxidative stress, and also showed significant antioxidant capacity (e.g. high scavenging abilities of DPPH and NO with the highest FRAP values comparing to other extracts), which may be a determinant of pedunculate oak acclimation to microsite conditions. Obtained results may serve as a tool for explaining differences in physiological and biochemical adaptation to specific ecological conditions on different micrositeswithin the same forest complex, and improvement of management strategies and regeneration abilityof pedunculate oak.

Keywords: *Quercus robur L., water availability, physiological stress, antioxidant capacity, forest management.*

THE CHAOTIC WHEAT PRODUCTION GROWTH MODEL: CHINA

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Abstract

Chaos embodies three important principles: (i) extreme sensitivity to initial conditions ; (ii) cause and effect are not proportional; and (iii) nonlinearity.The basic aims of this paper are : firstly, to create the simple chaotic wheat production growth model that is capable of generating stable equilibria, cycles, or chaos; and secondly, to discover a sequence of Elliot waves in wheat production in China in the period 1981-2003. This paper confirms the existence of the stable convergent fluctuations of wheat production in China in the observed period.

Key words: *Wheat, Productioni, Stability, Chaos, Elliot Waves.*

MORPHOLOGICAL CHARACTERISTICS AND VARIABILITY OF THE SEEDLINGS OF WILD CHERRY (*PRUNUS AVIUM* L.) IN SERBIA

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Abstract

Wild cherry (*Prunus avium* L.) is one of the most important forest fruit species. It is very valuable forest tree species which grows in mixed forests of South, Central and West Europe. In forests of Serbia it belongs to the group of endangered species which enough attention is not paid to. The main characteristics of seedlings, their individual variability as well as the variability between and within populations were shown using Comparative Morphometric Analysis of half-sib lines of wild cherry originating from seven natural populations. Seed for seedling production was collected in nine natural populations of wild cherry in its natural distribution area in Serbia. The trial was established in the seedling nursery of Institute of Forestry in Belgrade (Serbia). On the sample of 30 seedlings as per half-sib line at their age of 30 days the following characteristics were measured: length of a root, length of a epicotyl, a hypocotyl and a cotyledon, a cotyledon width, mass of a seedling, root collar diameter and number of cotyledons. Descriptive and multivariate statistical methods were used in the study. The obtained results contribute to the knowledge of the analyzed characteristics, the preliminary assessment of the genetic variability at the level of the studied half-sib lines and populations. The presented results are the basis for the continuation of the research which is necessary to be carried out in order to provide guidelines and recommendations for the preservation and targeted use of wild cherry genetic resources on the territory of Serbia.

Keywords: *Wild cherry, seedling, half-sib line, variability, population.*

VARIABILITY OF MORPHOMETRIC CHARACTERISTICS OF SESSILE OAK (*QUERCUS PETRAEA* (MATT.) LIEBL) ACORN

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Abstract

The research of intrapopulation variability on the basis of morphometric characteristics of acorn was conducted for the purpose of conservation of the available gene pool of sessile oak in the population in the area of Avala Landscape of Outstanding Features and controlled use of genetic resources. Fifty trees of the best quality based on phenotype characteristics, the healthy bearers of sessile oak (*Quercus petraea* (Matt.) Liebl) reproductive material production were selected at the population level. In October 2019, ca. 5 kilograms of healthy, normally developed acorns were collected from each of the test trees. On the sample of 50 acorns per tree, length, width and mass of the acorn were measured. The volume and the shape index of acorns were calculated on the basis of measured values of length and width. The mean values of morphometric characteristics obtained in the research indicate that there is a high variability among the studied genotypes. The latter is confirmed, also, by the analysis of variance which determined statistically significant differences among the sampled mother trees for all the observed morphometric characteristics. The obtained results represent a good starting point for future research in breeding, long-term conservation and improvement of ecological adaptability and evolutionary potential of sessile oak population by means of implementing adequate measures of in situ and ex situ conservation.

Keywords: *Sessile oak, acorn, population, genetic variability.*

SOCIO ECONOMIC STATUS & AGROFORESTRY READINESS: A CASE STUDY OF SELECTED COMMUNITIES IN THE OR TAMBO DISTRICT, EASTERN CAPE IN SOUTH AFRICA

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Abstract

This study pointed to the state of the community in terms of their socio economic and agroforestry readiness in the OR Tambo District, which receives a median annual rainfall ranging between 800 and >1000 mm. In addition to favourable climatic conditions, the district has two plantations, namely the Mkambathi and Gqukunqa Forestry Enterprises, offering fertile ground to revive existing plantations, meaning that the community could immediately reap the benefits from the clear felling of the existing timber and agroforestry practices. Furthermore, the Agricultural Research Council conducted an assessment in collaboration with the Department of Agriculture, Land Reform and Rural Development aimed at identifying the community's socio economic status. Fifty-six community members from five local municipalities were selected, using a purposive sampling technique, and assessed. Quantitative and qualitative research designs were employed, as a structured questionnaire in English was developed, focus group and stakeholder discussions were held, as well as field observations to elicit information for the study. Data was coded, captured, and analysed using the Software Package for Social Sciences. The decantal 1km X 1km approach was followed to determine the climatic conditions of the two plantations. Currently, the profitable and suitable crops like dry beans, sugar beans and groundnuts were recommended to the stakeholders for agroforestry integration. The study recommended the establishment of agroforestry in the OR Tambo District as it satisfied the basic requirements for agroforestry readiness, i.e. good climatic conditions, land availability, availability of production inputs and the community's socio economic status and involvement, towards food security.

Key words: *Socio Economic, Agroforestry, OR Tambo District, Eastern Cape Province and South Africa.*

SUITABILITY OF WOOD OF NATIVE OAK SPECIES (*QUERCUS* spp.) FROM THE IBERIAN PENINSULA NORTHWEST FOR COOPERAGE

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Abstract

In the northwest of Iberian Peninsula, the oak wood is scarce used in the forestry industry. Small plots and many owners do not facilitate its exploitation, as well as the later industrial development. Forest management of oak forests is virtually non-existent and the use of oak wood is limited for firewood. This is one of the main reasons why it would be essential to develop a specific industry that contributes to the valorisation of these species. The aim of our research was to study the characteristics and/or properties of wood of native oak species for the manufacture of wine aging barrels. For more than 15 years, from 1993 to 2010 approximately, several inventories were carried out in oak forests of the most abundant species of the *Quercus* genus in the northwest of the Iberian Peninsula, in Galicia, particularly. Subsequently, we calculated the essential parameters of the wood using samples of different oak species felled in the inventoried forests to assess the suitability of their wood for cooperage. At first, this would allow us to even propose in advance whether to carry out certain silvicultural treatments to achieve our goal. The overall objective was to make a description of the most important properties of the wood of these species on the barrel manufacture for aging wines. The current study about wood properties of *Quercus robur* L. and *Q. pyrenaica* Willd. is based on the determination of bark, sapwood, and heartwood to assess their variation in the Galician oaks. *Quercus robur* has a higher proportion of bark (22.9%) than *Quercus pyrenaica* (17.6%), but the high coefficient of variation associated with this value (62.7%) moderate this statement.

Keywords: *Atlantic oaks, Bark, Heartwood, Sapwood, Wine aging.*

CERTIFICATION SYSTEM FOR SUSTAINABLE FOREST MANAGEMENT OF CORK TREE (*QUERCUS SUBER* L.) FORESTS

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Abstract

Sustainable Forest Management (SFM) seeks to make sure a performance of forest ecosystems environmental and socioeconomically just. The cork oak forest management presents a complex problem because silvicultural peculiarities. The aim of the SFM, to guarantee a functioning of forest ecosystems environmental and socioeconomically adequate, is difficult to achieve in the Mediterranean forests, because they have a limited capacity to reply to the systematic changes, human impacts, wide climatic, edaphic, and biological variability, and a complicated socioeconomic environment. Given its heterogeneity, the management of these ecosystems represents a multifaceted problem, being particularly significant in the cork oaks because of their silvicultural features. The key aspect of the cork oak silviculture is the production of cork, which is separated regularly without cutting down the trees. Cork oak stands need a SFM to resolve their major problems: scarce natural regeneration, ageing of stands, quality loss, severe pruning, and cork oak decline ("seca"). Cork is the outer bark of the cork oak (*Quercus suber* L.), an evergreen tree species belonging to the *Fagaceae* family. Its chemical composition is different from other lignocellulosic raw materials. It is light, squeezable, and impermeable; it has low thermal conductivity, energy-absorbing capacity, and high friction resistance. The best sheets are used for manufacturing natural stoppers, vital in the aging process of "great" wines. The cork oak is a Mediterranean species covering a global area of about 2,2 million hectares; Portugal and Spain being the countries where it occupies a larger area. Our goal was to consider possible options for carrying out a forest certification system in small stands of cork oak with a lower area of 25 hectares. These forests are essential agents of sustainability and a driving force for sustainable rural development. They play a crucial role in the world's ecological balance, fighting climate change and desertification and maintaining biodiversity.

Keywords: *Mediterranean western, Quercus suber L., Cork oak stands, Properties.*

DETERMINATION OF *SALVIA OFFICINALIS* L. VOLATILE CONSTITUENTS BY SPME METHOD

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Abstract

Sage (*Salvia* L.) is a valuable medicinal and aromatic plant from the *Lamiaceae* family. Although there are about 900 taxa of the genus *Salvia*, which is affiliated to the *Lamiaceae* (*Labiatae*) family, the most commercially valuable ones are *Salvia officinalis* L., which is called Medicinal sage or Dalmatian sage. In this study, volatile components of *Salvia officinalis* sage were determined by solid-phase micro extraction (SPME) technique. The aim of this study is to examine the effect of different brewing times on the change of volatile compounds in sage leaves.The extraction of volatile compounds (VCs) was carried out in a water bath at 50 degrees Celsius. After the samples were kept in the water bath for 10, 20 and 30 minutes respectively, the fiber was placed in the headspace bottle and held for 30 minutes. In these techniques, major volatile components were determined as thujone, eucalyptol and camphor. Major components were determined as thujone 28.65%, eucalyptol 15.03% and camphor 11.94% in vials kept in water bath for 10 minutes. In vials kept in water bath for 20 minutes, major components were determined as thujone 37.29%, eucalyptol 15.88% and camphor 14.12%. In vials kept for 30 minutes, major components were determined as thujone 44.21%, eucalyptol 15.66% and camphor 10.88%, respectively. It was observed that thujone ratios increased according to the waiting times of the vials in the water bath.

Keywords: *Salvia officinalis L., SPME, Sage. Lamiaceae.*

CHANGE OF ESSENTIAL OIL RATIO AND COMPONENTS OBTAINED BY DIFFERENT METHODS IN LAUREL AND MYRTLE PLANTS

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Abstract

Medical and aromatic plants are divided into two groups, those collected from nature and those that are cultivated. Medical and aromatic plants collected from nature are plants that grow spontaneously in natural places such as forests. Two of these plants commonly grown are *Laurus nobilis* L. and *Myrtus communis* L. This study was carried out in order to determine the ratio and components of essential oils obtained by different methods (hydrodistillation, steam distillation and boling distillation) of laurel trees and myrtus growing densely in Hatay flora of Turkey. Hydrodistillation method is a traditional method widely used in obtaining essential oils made with a Clevenger type apparatus in small-scale productions. Whereas, steam and boiling distillation method is carried out in large distillation boilers (retort) in industrial applications. Previously it was determined that the essential oil ratios in Clevenger were between 2.5-3% in laurel, 1.5-2% in myrtle plant. In the essential oils obtained by retort methods (steam and boiling distillation), these ratios were observed between 0.8-1.2% in laurel and 0.3-0.7% in myrtle plant. When the essential oil components were examined, the main components of laurel were determined as eucalyptol, α-terpinyl acetate and sabinene in all methods. Main components of laurel essential oil in the Clevenger were determined as eucalyptol 54.85% α-terpinyl acetate 18.52% and sabinene 3.25%, respectively. Whereas, components obtained by retort methods (steam and boiling distillation) were determined as 57.53-44.48% eucalyptol, 12.06-8.94% sabinene and 7.59-17.98% α-terpinyl acetate. The main components for the myrtle plant were determined as α-pinene, eucalyptol, linalool. Linalool was replaced by limonene in the retort methods.

Key words: *Laurus nobilis L., Myrtus communis L., Essential oil, Clevenger, Retort.*

ADDITIONAL ABSTRACT

(Environmental Protection and Natural Resourcees Management section)

ENERGY POTENTIAL OF THE WHITE MULBERRY WASTE BIOMASS

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Abstract

Morus alba L., is one of numerous species in the Moraceae family. Nowadays, the white mulberry is known mainly as a fodder for mulberry silkworm (Bombyx mori L.). Nevertheless, great potential of this plant enables its multidirectional use in various industries. Very fast growth of mulberry results the possibility of use its biomass as a feedstock for producing biofuels. For this purpose, the best solution is using the waste biomass remaining after the spring cutting of plants for sericulture. The mulberry biomass yield depends mainly on the rotation period of mulberry biomass harvest. In the experiments carried out in Pętkowo Experimental Farm of the Institute of Natural Fibres and Medicinal Plants - National Research Institute the highest yield was observed for 5 years rotation period (61.2 Mg of DM per 1 ha) and the lowest for annual harvest (8.97 Mg, respectively). The calorific value of mulberry pellets ranged from 16 680 to 17 830 MJ/Mg and depended on kind of biomass, the number of grindings and the amount of added potato starch used as a binder. The energy potential per 1 Mg of mulberry DM was also calculated. It ranged from 4.5 to 159.9 GJ/ha of produced energy amount.

Keywords: *Morus alba L., pellets, biofuels, chemical composition, energy calculation.*

AUTHOR INDEX

ERRATA CORRIGE

Pag. 778: Added abstract entitled „ENERGY POTENTIAL OF THE WHITE MULBERRY WASTE BIOMASS“ of authors: Jakub FRANKOWSKI, Małgorzata ŁOCHYŃSKA, Joanna GRZEŚKOWIAK.

Pag. 778: from this page all remaining pages are moved forward by one page.

Pag. 786: line 17. Instead of
Jakub FRANKOWSKI 527
Please read
Jakub FRANKOWSKI 527, 778