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2022



**BOOK OF
ABSTRACTS**

*XIII International Scientific Agriculture Symposium
"AGROSYM 2022"
October 6-9, 2022*



AGRO 2022
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PREFACE

Dear colleagues,

I am pleased to introduce the Book of Abstracts of the 13th International Scientific Agricultural Symposium “AGROSYM 2022”, which I hope you will find useful in your work. Almost 700 contributions have been accepted for the Book of Abstracts. The themes of AGROSYM 2022 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, vital 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 COVID-19 pandemic.

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

While attention has been paid in the past mainly to the production side (cf. productivity, efficiency), 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 about what they want on their tables i.e. higher quality as well as healthier, safer, and tastier products. Therefore, most agri-food companies have been exploring new, innovative ways to ensure more control over the production processes as well as final products quality and safety. Changes in investment strategy also have the potential to reduce the environmental and social costs of agriculture. It is now clear to most investors that companies paying more attention to sustainability and social responsibility, will have better returns on investments.

Agri-food systems have been central in the global debate on sustainable development and the achievement of the Sustainable Development Goals (SDGs) by 2030. 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 develop farming systems that mitigate or eliminate environmental harms associated with industrial agriculture. It is also crucial to improve the resilience of food systems to crises, shocks and pandemics.

Many thanks to all the authors, reviewers and colleagues for their assistance 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 2022

Prof. Dušan Kovačević, PhD

Editor in Chief, President of the Scientific Committee of AGROSYM 2022



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AGRICULTURAL KNOWLEDGE AND INNOVATION SYSTEMS (AKIS) IN THE EUROPEAN UNION

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Abstract

There is a broad consensus that knowledge is a key resource to support the European agriculture in meeting the new challenges. To encourage knowledge exchange and support innovation, the new Common Agriculture Policy (CAP) reform (2023-2027) envisages strengthening each member states' Agricultural Knowledge and Innovation System (AKIS). Conversely, little is known about AKIS situation in many countries. Furthermore, the capacity of decision makers to contribute to the AKIS governance is underdeveloped. Using the AKIS concept, which describes the exchange of knowledge and the services which support these exchanges in agriculture, we cross analysed 28 AKIS country reports produced in the frame of the i2connect project. Our results present (i) the diversity of the AKISs in the EU and some selected European countries; (ii) several key features in AKIS that substantially contribute to the systems' functioning and performance; and (iii) an assessment of the typology of advisory service providers, capacity, clients and topics. Generally, a huge variation in AKIS composition and performance among the investigated countries is observed. Pluralism of AKIS actors is recognisable at the national level, particularly in western Europe. The dominant constellation of actor categories comprises public administration, research and education bodies and farmer-based organisation. Most countries have a centralised AKIS governance at the national level. Mechanisms for coordinating AKIS actors vary in type, duration, and actor composition among and within the counties. The European Agricultural Fund for Rural Development is used to implement AKIS related programs. Public advisory organisations, followed by farmer-based organisations, are the primary providers of information and advice to farmers. The History, political, socio-cultural and economic contexts influence the composition and performance of AKIS in a country. Equally, farming systems, types of value chains and the organisational nature of actors, the subsystems, their importance, linkages, etc., affect the AKIS performance within a country.

Keywords: *agriculture, knowledge, innovations.*

GENOME EDITING IN GRASS PLANTS

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Abstract

CRISPR systems have been engineered into powerful biotechnological tools for both basic and applied research. The most promising utilization of CRISPR technologies is for targeted genome editing, leading to precise genetic alterations within any genome of interest, as demonstrated in a plethora of organisms including several important crop plants. Programmable nucleases (e.g., CRISPR RNA guided Cas nucleases) have been successfully engineered to induce site-specific mutations (deletions, insertions, and substitutions) at genomic loci in grass plants such as rice, maize, wheat, sorghum, etc. The genome editing tools have significantly advance our basic understanding of gene function and engineering beneficial traits in grass species. In my presentation, I will provide our experience in developing and utilizing CRISPR/Cas based technologies for genome editing in several important grass species.

Key words: *genome editing, grass species, mutations.*

AGRICULTURE AND FOOD SYSTEMS BY 2050: CHALLENGES AND PROSPECTS

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Abstract

Agriculture and food systems have been central in the debate on sustainability and sustainable development. This is due, among others, to the fact that the activities, the governance and the outcomes of the agri-food systems determine how and whether humanity will succeed in addressing many challenges such as food insecurity, climate change and biodiversity loss. In this context, this review analyses the challenges facing the agri-food systems and explores their prospects, trends and perspectives by 2050. In doing so, it tries to analyse whether humanity can feed itself. Recent data show that 828 million people were affected by hunger in 2021 worldwide. This number can be reduced by increasing food production so food supply and availability. For that, it is necessary to increase agricultural land and/or productivity/efficiency (cf. high-yielding cultivars, fertilisers, pesticides, irrigation). Both options are constrained by many factors such as climate change and land and water resources scarcity and have many cons (e.g. biodiversity loss, deforestation, land degradation). On the other hand, demand is increasing because of population growth and increasing wealth and affluence. This already adverse scenario is further complicated by pandemics (e.g. COVID-19), conflicts/wars and multiple crises. Feeding the world in a sustainable way by 2050 implies acting synergistically both on the supply side and the demand side of the food chain. This includes, inter alia, promoting sustainable agriculture models, unlocking the potential of modern technologies in agriculture and food, reducing food losses and waste, and promoting sustainable diets. While food availability is important to achieve long-term food and nutrition security, it is paramount not to lose sight of the remaining dimensions of access, utilisation, stability, agency and sustainability.

Keywords: *agri-food systems, food security, sustainable development, food supply, food demand.*

PLANT PRODUCTION

INVESTIGIME MBI EFIKASITETIN E DISA BIOPRODUKTEVE NE KONTROLLIN BIOLOGJIK NDAJ HIRIT [*Uncinula necator* (Schw.)] NE HARDHI

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Abstract

Grape production methods of biological agriculture started in Albania since 2001 and currently occupies an area of 25 ha for production of wine and table grapes. Biological vineyards are concentrated in 15 farms with 1-5 ha sized mainly in Durres, Tirana, etc. Kavaja. The main challenge during this period has been the implementation of practices and methods in accordance with the standards of biological agriculture to ensure sustainability and increase the efficiency of biological production in the vineyards. The main attention is focused on maintaining and enhancing soil fertility through the addition of organic matter and biological activity. Along with organic manure, widely applied in biological vineyards green fertilization, and plant covers mulçërimi with different organic materials to control weeds and maintain soil moisture. The choice of suitable cultivars is one of the important elements for the success of cultivation methods of biological agriculture. Protection from diseases and pests is one of important challenges, including that from the application of various agro-technical methods and to the application of biotechnological methods (sex pheromones, biological preparations) and treatments allowed by the standard preparations. Precisely this was and the purpose of taking this study on the effectiveness of certain study biofungicideve and efficiency comparison of control with that treatment Bio traditional farm in the village Bio Hajdar Kuçi Marikaj Tirana against powdery mildew [*Uncinula necator* (Schw.)] in grapevine.

Key words: *vine, grape, biofungicide, treatment, tradition.*

PHYTOCHEMICAL SCREENING, ANTIMICROBIAL AND ANTIOXIDANT EFFICACY OF THE ENDOCARPS FRUITS OF ARGANIA SPINOSA L. SKEEELS (SAPOTACEAE)(MOSTAGANEM)

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Abstract

Argania spinosa, Sapotaceae sole representative in Algeria and Morocco, hence its endemic in these regions. Although it is a recognised oil, forage and timber tree highly adapted to aridity. The exploitation of the argan fruits, produces considerable amounts of under or related products. These products, such as the endocarps of a fruit, recuperated after use of kernels to extract oil. This research studies in detail the contents of total phenolic content was determined by Folin Ciocalteu reagent and Flavonoids by aluminum chloride colorimetric essay (Ksouri et al., 2008). Antioxidant activity of extracts was expressed as percentage of DPPH radical's inhibition and IC₅₀ values (µg/mL). Antimicrobial activity evaluated using agar disk diffusion method against reference *Pseudomonas aeruginosa* ATTC 27453, *Escherichia coli* ATCC 23922. Immature endocarps showed a higher polyphenol content than mature endocarps. The total phenolic content in immature endocarps was found to vary from 983,75+/- 0.45 to 980,1 +/- 0.43 mg gallic acid equivalents/g dry weight, whereas in mature endocarps, the polyphenol content ranged from 100,58 mg/g +/- 0.42 to 105 +/- 0.55% of GAE. The flavonoids content were 16.5 mg equivalent catechin/g dry weight and 9.81mg equivalent catechin /g dry weight for immature and mature endocarp fruits respectively. DPPH assay of the endocarps extract yielded a half-maximal effective concentration (IC₅₀) value in the immature endocarps (549.33 µg/mL) than mature endocarps (322 µg/mL) This result can be attributed to the higher phenolics and flavonoid compounds in the immature endocarps. Methanol extract of immature endocarps exhibited antibacterial activity against *E.colie* (inhibition zone, 11mm).

Keywords: *antioxidant activity; antimicrobial activity, total phenolic content; DPPH assay.*

USE OF COMPOST AND ORGANIC MANURE FOR GROWING BARLEY "HORDEUM VULGARE" IN THE BISKRA REGION

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Abstract

Our study was carried out at the Department of Agronomic Sciences of the University of Biskra during the agricultural year 2021-2022, in order to compare the effect of compost (T1), manure (T2) and control (T0) on the cultivation of barley "Hordeum vulgare". Growth characteristics, morphological characteristics and yield components were measured. The results obtained show that the three treatments have almost the same effect on the growth parameters and the morphological characteristics, but on the other hand, for the production characters, it was noticed that the number of ears per m² and the number of grains per cob are almost the same for the different treatments T2, T1 and T0 on the other hand the greatest thousand grain weight was obtained for the treatment T2 (manure) with the value of 53g and T0 (control) has the lowest PMG with the value of 37.67g, the straw yield, the highest was for T0 with the value of 90.3 qt/ha compared to the other treatments, the best theoretical yield is obtained for T2 (57.99 qt /ha) compared to T0 and T1 and for the harvest index, the T2 treatment gave the highest harvest index with the value of 33.61% and the lowest value is for the T0 treatment with the value of 28.26%.

Keywords: *Compost, manure, barley crop, Biskra, growth characteristics and morphological theoretical yield.*

EVALUATION OF ANTIMICROBIAL ACTIVITIES OF ESSENTIAL OIL AND SOLVENT EXTRACTS OF *CISTUS CRETICUS*

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Abstract

The interest of modern pharmacognosy, in particular compounds that occur in the plant materials, is due to their therapeutic effect which can be obtained by direct use of plant materials or by use of active substances isolated from the plant tissues. The present work aims to study the antimicrobial activity of *Cistus creticus*, a plant belonging to family Cistaceae, growing in the north-east of Algeria. *Cistus creticus* were collected during the flowering period. Flowers, stems and leaves of the plants were cleaned of impurities, dried in shade at room temperature then grounded to powder. The powders obtained were used to extract essential oils by hydrodistillation (Clevenger) and crude extracts using different solvents (methanol, chloroform and petroleum ether). The antimicrobial activity of essential oils and the extracts of the studied plant, at a concentration of 50 mg/ml, was evaluated in several bacterial strains (*Staphylococcus aureus* CIP, *Salmonella* sp, *Shigella* sp) and two fungi (*Aspergillus Niger*, *Aspergillus flavus*). The results obtained show that the essential oil and the three extracts of *Cistus creticus* have an antimicrobial activity on all the bacterial and fungal strains, except in the case of *Aspergillus flavus* with petroleum ether extract where the sensitivity of the germ is limited. The methanolic extract shows an important activity against bacterial and fungal strains. The chloroform extract of the same plant has an acceptable activity except with *Salmonella* sp and *Aspergillus flavus* which show a low activity. The petroleum ether extract also have an important antimicrobial activity observed on *Staphylococcus aureus* and *Shigella* sp. bacteria and an acceptable activity against the rest of the germs. *Cistus creticus* possesses an antimicrobial activity towards the strains used.

Key words: *Cistus creticus*, antimicrobial activity, secondary metabolites, bioactive compounds.

PHYSICAL CHEMISTRY ANALYSIS AND MORPHOLOGICAL/ANATOMICAL STUDY OF *ROSMARINUS OFFICINALIS*

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Abstract

The purpose of this work is to investigate the physicochemical properties of *Rosmarinus officinalis* secondary metabolites in addition to a biological study for better knowledge. The literature indicates that this plant exhibits anti-inflammatory and antiviral properties. The plant was collected from mountains surrounding the city of Batna in the east of Algeria. A morphological study of the plant carried out in its native place and anatomical study carried out in the laboratory using fresh parts and double coloration method. Aerial parts (leaves and stems) were collected, cleaned of impurities and dried for one week at room temperature in shaded and ventilated place before being grounded to powder. This latter was subjected to various analyses: i) Phytochemical analysis using extraction with petroleum ether, dichloromethane and methanol ii) qualitative determination of secondary metabolites and iii) calculation of ash percentage and metals content. The results showed that the extraction yield was higher using dichloromethane (6.2 %) compared to methanol (3.8%) and petroleum ether (2.4 %) while the phytochemical screening revealed the presence of tannins, alkaloids, flavonoids, heterosides, triterpenes, cyanidin and saponosides. Furthermore, it was found that the plant ash was about 24,5 % and its contents of toxic metals such as Hg and Pb were very low which render the plant harmless.

Key words: *Rosmarinus officinalis*, Phytochemistry, Trichomes, Secondary metabolites.

STUDYING OF THE ANTHOCYANIN CONTENT OF DARK GRAIN MAIZE IN RELATIONSHIP WITH THEIR MORPHOLOGICAL TRAITS

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Abstract

Maize (Zea mays L.) is the staple food for most of the world population. Among the many beneficial components to human health, various organs of maize also contain anthocyanin pigments. The anthocyanins have antioxidant, anti-inflammatory and anti-carcinogenic properties, which reduce the risk of cardiovascular and neurodegenerative diseases, diabetes, obesity and slow cancer progression. Based on this we obtained 18 dark-grain inbred lines by self-pollination and selection of local maize forms at the Genetic Resources Institute of Azerbaijan. The composition and content of the anthocyanins of grains and economically important morphological traits of these samples were studied. Cyanidin and pelargonidin glucosides, as well as their malonized derivatives, were identified in the grains extracts by high performance liquid chromatography. The total level of anthocyanins accumulation was in the range of 0.0073-0.027 g per 100 g of dry weight. To assesment economically important morphological traits and identify their relationship with the grain color were studied: flowering time, plant height and number of leaves, cob indicators (mass, length, diameter, number of rows of grains) and 1000 -grain mass. In the phase of wax ripeness the color spectrum of the grains were analyzed. For some samples, a combination of morphological traits of plant productivity with dark color grains was revealed. Thus, perspective parental forms have been selected for maize breeding to a high content of anthocyanins in grain.

Keywords: *dark grain mayz, anthocyanins, high performance liquid chromatography, morphological traits.*

THE STUDY OF PHOTOSYNTHETIC GAS EXCHANGE PARAMETERS OF BREAD WINTER WHEAT UNDER VARIOUS WATER SUPPLY

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Abstract

Water scarcity is the main limitation for plant growth and productivity. Gas exchange parameters of field grown 21 winter bread wheat genotypes were studied by using LI-6400 XT Portable Photosynthesis System. The average values of photosynthesis rate (P_n), stomatal conductance (g_s), and transpiration rate (T_r) for all genotypes were found to be higher in the morning and afternoon hours in the irrigated variants compared to drought-exposed plants. In the morning hours, the average values of P_n , g_s , and T_r for all genotypes in the stressed and irrigated variants were, respectively, 11.8 and 21.1 $\mu\text{mol CO}_2 \text{ m}^{-2}\text{s}^{-1}$, 0.103 and 0.395 $\text{mol H}_2\text{O m}^{-2}\text{s}^{-1}$, 2.58 and 7.31 $\text{mmol H}_2\text{O m}^{-2}\text{s}^{-1}$, and in the afternoon hours, 11.9 and 19.6 $\mu\text{mol CO}_2 \text{ m}^{-2}\text{s}^{-1}$; 0.083 and 0.266 $\text{mol H}_2\text{O m}^{-2}\text{s}^{-1}$; 2.58 and 5.81 $\text{mmol H}_2\text{O m}^{-2}\text{s}^{-1}$. While the rate of photosynthesis was close at both measurements, in both stressed and irrigated variants, a decrease in stomatal conductance and transpiration rate (in the irrigated variant) was observed during the afternoon measurements. Genotypes with high T_r values were also found to have high stomatal conductance, while genotypes with low T_r had low stomatal conductance, indicating that T_r is mainly regulated by stomatal conductance. Stomatal conductance was more important in the course of photosynthetic processes during relatively mild drought conditions.

Keywords: *bread wheat, water supply, photosynthesis, stomatal conductance, transpiration.*

DNA MARKERS AS A MEANS OF ASSESSING THE GENETIC DIVERSITY AND IDENTIFICATION OF GRASSES

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Abstract

The effectiveness of breeding depends largely on the presence of the gene variability in the initial breeding material. The genetic variability assessment helps to evaluate the source material during creating a fundamentally new forms with economically valuable traits. In this regard, the assessment of the genetic polymorphism of the genotypes of cereal grasses, which are valuable both a source breeding material and a candidate for a variety was carried out by DNA markers. Seventy-three loci were identified for the *Festulolium* and *Lolium L* genotypes using the SCoT marker system, 69 of them were polymorphic. The used marker system revealed a high level of polymorphism in the studied genotypes of *Festulolium* and *Lolium L* - 94.52%. For the genotypes of intergeneric hybrids of the *Agropyron L.* genus and their parent forms 90 loci were identified - 46 SCoT markers and 44 SRAP markers. From the total pool of markers, 73 markers were polymorphic. On average, the level of polymorphism was 81.1%. For the genotypes of interspecific hybrids of the *Alopecurus L.* genus and their parent forms, 157 loci were identified - 52 for RAPD-PCR and 105 for ISSR-PCR. Of the total pool of markers, 104 were polymorphic with a polymorphism level of 66.24%. According to the results the genotyping by DNA makers, genetic passports of cereal grasses were compiled.

Keywords: *cereal grasses, genetic passport, genotype, SCoT markers, ISSR, RAPD, SRAP.*

MODERN BIOTEHNOLOGICAL APPROACHES TO THE BERRY CROPS STUDY (*VACCINIUM CORYMBOSUM* L.)

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Abstract

The biotechnology development promotes the new approaches to the study of economically valuable crops – the biochemical and molecular markers usage (proteins and nucleic acids). Modern methods allow solving the problem of genotype identification, as well as a number of issues related to the property rights protection, plant material safety control, the appreciable varieties conservation, etc. For the first time the highbush blueberry *Vaccinium corymbosum* L. molecular genetic identification was carried out and the genetic passports were elaborated using the SCoT marker system. This marking system provides the possibility of checking the variety conformity of planting material. The obtaining data will also can be used for copyright protection and in marker-associated plant breeding of the *Ericaceae* JUSS. family. Proteomics makes it possible to characterize plant species and to identify putative molecular markers of species and varieties and to reveal protein markers of the functional state of the plant organism. For the first time the total proteome investigation of *Vaccinium corymbosum* L. by 2D - electrophoresis were performed using the Protean i12 IEF Cell automatic station (Bio-Rad, USA) and the proteomic maps of five high bush blueberry varieties has been obtained. The proteomic maps (biochemical passports) will make it possible to develop methods for plant biological productivity and to carry out a quick selection of crops that are promising for biotechnological production. The proteomic maps as well will be useful as the test systems of the plant organism state at different stages of its growth and development or to identify the targets of regulatory impact. The obtained results develop the biology of valuable berry crops as well as the scientific approaches to their usage in the economics and biotechnology.

Keywords: *Vaccinium corymbosum* L., proteomic map, genetic passport, biotechnology, copyright protection.

DOMESTICATION OF *CRASSOCEPHALUM CREPIDIOIDES* (BENTH.) S. MOORE. WILD LEAFY VEGETABLE: OPTIMAL FERTILIZATION WITH ORGANIC MANURE AND REJECTION DYNAMICS AFTER CUTTING.

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Abstract

Crassocephalum crepidioides is a spontaneous wild annual plant commonly called Gbolo. It is a traditional vegetable covered with leaves that can contribute to improving food security and the income of rural populations, particularly women. It is found on cultivated land and exploited for a short period from July to September each year. The objective of this study is to proceed with the conservation of the species through domestication for sustainable use. This determined the optimal dose of soil fertilization based on cow dung and made an assessment of the dynamics of rejection of strains of *C. crepidioides*. The study was conducted in market gardening at the University of Parakou according to a Fisher block device comprising three blocks of plots and five treatments (T0= 0kg/m², T1= 3.48kg/m², T2=5.48kg/ m², T3 =7.48 kg/m² and T4 = 9.48 kg/m²) randomly distributed at the level of each block on the experimental plots of dimensions 1m x 1m side. The plants are transplanted following a spacing of 30cm x 30cm. For the evaluation of the dynamics of rejection, the plants are sectioned according to three heights of cut 3 cm, 5 cm and 7 cm from the ground. The results obtained showed that fertilization has a very significant effect ($P < 0.05$) on the agronomic performance of *C. crepidioides*. The vegetative growth of the best *C. crepidioides* plants is obtained for the dose of 3.48 kg/m² (TaNf, 24 hours = 5.75%; Ht = 24.07 cm; Nen = 4.55; Nf = 29 .22; Lf = 21.53 and lf = 6.82). *C. crepidioides* showed a great ability to reject stumps according to cutting heights ($P < 0.05$). The highest stump rejection density (Rs = 6.75; Nf = 68.11; Lf = 14.48 cm and lf = 5.44 cm) is obtained for the 7 cm cutting height. This cutting height gave the best stump tracking rate after the first cut (100%) and the second (51.11%). The comparison of the fresh biomass obtained at the second harvest (Nf = 50.47; Mf = 82.5g and Ms = 10.6g) is higher than the first harvest (Nf = 23.22; Mf = 8.3g and Ms = 10.6g). Fertilization of 3.48 kg/m² of organic matter and a cutting height of 7 cm are optimum for the production of *C. crepidioides* in market gardening.

Key words: Domestication, Stump rejection, wild leafy vegetable, organic fertilization, cow dung.

CARROT QUALITY DEPENDING ON THE TYPE OF ROOT

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Abstract

The anatomical structure of the carrot root is composed of: cork tissue, phloem and xylem. The best quality part of the carrot is the phloem because it contains biologically active substances important for human health. Phloem development is different depending on the type of carrot root. Depending on the shape of the carrot root, carrots are divided into four basic types: round, braunschweig, shantene and nantes. Taking into account the fact that the nutritional value is in the root rind, the aim of the study was to determine how much the shape of the root affects the participation of root rind, ie the quality of carrots. We examined three types of carrot root: spindle-type Braunschweig carrot, cone-type Shantane, cylindrical-type nantes. On a sample of 10 plants of different carrot root types, we analyzed: root mass and length, participation of root rind (%). The type Braunschweig has a statistically significantly higher share of root rinde (50.33%) compared to the type Shantene (42.66%) and type Nantes (44.33%). There was no statistically significant difference in root rind participation between the type Shantene and the type Nantes. The quality of the type Braunschweig is good because participation of root rind is 50.33%, while the other two tested types (shantene, nantes) have poor quality because the participation of root rind is below 50%.

Keywords: *carrot, type of root, quality.*

DETERMINATION OF PHYSICAL AND CHEMICAL PROPERTIES OF FRUITS OF DIFFERENT PEAR VARIETIES

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Abstract

Pear (*Pyrus communis* L.) is a deciduous tree from the rose family (Rosaceae). It grows up to 12 meters in height, forming a large, dense, round crown. The flesh of the fruit is whitish-yellow, wrapped in yellow or green rind, it is very juicy with a characteristic aroma. The quality of our domestic pear varieties is much lower than noble Western European ones. However, domestic varieties also have their advantages, because they adapt much better to poorer climatic and soil conditions, are more resistant to plant diseases and pests, have stable productivity, are more durable, and can have a high sugar content or total nutritional value. This research aimed to physically and chemically characterize three different varieties of pears grown in the area of Visoko (Bosnia and Herzegovina), and to evaluate the potentials of the varieties Butira, Viljamovka, and Santa Maria. After the completed analysis, it can be concluded that the variety of Butira had the highest fruit weight, while the height, width of the fruit, and length of the stalk had the highest value in the variety Viljamovka. The fruits of the Santa Maria variety had the highest average number of pits. After chemical analysis, the samples of the Viljamovka variety had the highest values of all examined parameters. The Butira variety had the lowest pH value and total acid content, while the Santa Maria variety had the lowest amount of soluble dry matter, as well as total inverts.

Keywords: *pear, pH value, dry matter, total inverts, total acids.*

THE FRUIT GENETIC RESOURCES PRESERVATION IN BOSNIA AND HERZEGOVINA

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Abstract

The development of fruit science and work on collecting the fruit gene pool in B&H started with the State Experimental Fruit Growing Station founded in Goražde in 1937. This station was neglected after World War II, although it had all the chances to become the leading center for fruit growing in the Western Balkans. The new one collection was established in Sarajevo (Betanija) as a organizational part of the Faculty of Agriculture Sarajevo with about 14,000 trees of commercial, old and autochthonous cultivars of apples, pears, plums, cherries, hazelnuts. This collection gradually lost support and became neglected and during the last war in B&H (1992-1995) was completely destroyed. The third attempt to establish fruit national collections occurred with SEEDNet project and two gene banks were established (Banjaluka and Sarajevo). The gene bank in Banjaluka was institutionalized within the Institute for Genetic Resources (IGR) in 2009. The gene bank in Sarajevo has not come to life institutionally, but the apple and pear collection in Srebrenik was recognized as the one fruit collection. Within the IGR Gene Bank, three field fruits and two vine collections have been established. Pomological and molecular characterizations of pear, apple, cherry and grapevine have been performed. Protocols for in vitro preservation of pear, vine and strawberry have been developed. A multiplication program for on-farm conservation has been launched. These ex situ and on farm conservations contribute significantly to the program of conservation of plant genetic resources in BiH.

Key words: *field collection, characterization, on farm conservation.*

INFLUENCE OF LOCATION AND YEAR ON GRAIN, PROTEIN AND FAT YIELD OF SELECTED FORAGE PEA VARIETIES

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Abstract

Fodder peas represent a cheap and high-quality component for the production of bulky, that is, concentrated fodder. Cultivation of one-year forage legumes in the production conditions of Republika Srpska and Bosnia and Herzegovina does not have a long tradition, which is why two-year research (2016 and 2017) was conducted in two locations (Eastern Sarajevo and Banja Luka) with five varieties of spring fodder pea, intended for grain production (NS Javor, Baccara and NS Dukat) and the combined method of exploitation (NS Junior and Saša). Basic tillage of the soil at both locations was done in late autumn, to a depth of 25 cm, and pre-sowing soil preparation in the spring to a depth of 8 to 10 cm. A combination of mineral fertilizer N8P24K24 in the amount of 350 kg ha⁻¹ was used for nutrition. The field experiment was set up according to a randomized block system in four replications. Among the traits, the following were monitored: grain yield per unit area (kg ha⁻¹), grain protein yield (kg ha⁻¹) and grain fat yield (kg ha⁻¹). The statistical processing of the obtained research results was done using a three-factor analysis of variance (variety x locality x year). In the years of testing, the highest grain yield was in the NS Javor variety, followed by the NS Dukat variety, and in third place was the Baccara variety. Varieties for combined purposes NS Junior and Saša had a significantly lower grain yield compared to varieties for grain production, which was also reflected in the total yield of raw proteins in pea grains. The fat yield of fodder peas varies depending on the variety, the year and the region where it is grown. Given that such research was carried out for the first time in the areas of Banja Luka and East Sarajevo, it is possible to apply the obtained results in practice.

Keywords: *fodder pea, yield, proteins, fats, variety, locality, year.*

QUALITY AND ENERGY VALUE OF FEED PEAS

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Abstract

Peas represent an important leguminous component in various cropping systems and are one of the higher-quality plants that can provide an answer to the global needs for protein in human and domestic animal nutrition. The great advantage of growing peas is that they are sown early, they make good use of winter moisture reserves and spring rainfall. In two years of research (2016 and 2017) on the experimental field of the Faculty of Agriculture in East Sarajevo with four varieties of spring field pea (NS Junior, Saša, Menhir and Dora), the faculty laboratory analyzed the quality and energy value of field pea (dry matter content ; content of mineral substances; content of crude proteins; content of crude cellulose, content of crude fatty substances; proportion of nitrogen-free extractive substances), while the energy value (MJ kg⁻¹ of dry matter) is calculated based on the results of chemical analyzes of the above-ground mass of the plant and is expressed as net energy for lactation (NEL), i.e. net energy for growth and meat production (NEM). The statistical processing of the obtained research results was done by two-factor analysis of variance (variety x year). Testing the significance of differences between individual and interaction means was performed with the LSD test. Analyzes of variance were conducted using the GenStat (2012) software package. The Dora variety had the highest content of dry matter, protein, cellulose and fat, while the Menhir (NEM) and NS Junior (NEL) varieties had the highest nutrient value. A lower crude protein content was achieved in 2017, which was less favorable for the cultivation of fodder peas compared to 2016. In 2016, there was a higher content of cellulose, BEM, as well as the energy value of nutrients (NEL and NEM), while in 2017, there was a higher content of dry matter, mineral matter and fat.

Key words: *peas, proteins, fats, cellulose, energy value, varieties.*

EXAMINATION OF THE VIABILITY OF BARLEY SEEDS USING THE TETRAZOLIUM TEST

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Abstract

For seed quality control of various plant species since most commonly used tetrazolium test because it allows a rapid evaluation of viability. Freshly harvested barley seeds show dormancy that can make the germination test ineffective for an immediate evaluation. Therefore, the development of more efficient methods, such as the tetrazolium test, is necessary. The objective of this research work was to study various procedures for performing the tetrazolium test on barley seeds. Seeds cultivar Simonida were used and subjected to the following treatments: seed preconditioning with direct immersion in H₂O 18 hours; preparation for staining -longitudinal cross-section of the seed through the embryo with disposal of one of the halves and staining the other half and second, seeds were longitudinally cross-sectioned through the embryo, staining the two halves. Two methods of staining on top of filter paper and direct immersion in the tetrazolium salt solution. Three concentrations of the tetrazolium salt solution (0.1%, 0.5%, and 1.0%) were used. It was concluded that the tetrazolium test on barley seeds may be accomplished with preconditioning by direct immersion in H₂O and staining on top of filter paper moistened with solution at a 0.5% concentration of the tetrazolium salt.

Key words: *Hordeum vulgare*, tetrazolium salt, concentrations.

THE INFLUENCE OF THE ROOTSTOCK ON THE PROPERTIES OF LEAF OF PLUM (*PRUNUS DOMESTICA* L.) CULTIVARS

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Abstract

Properties of leaf of three plum cultivars ('Cacanska Rana', 'Cacanska Lepotica' and 'Cacanska Najbolja') grafted on four rootstocks (Myrobalan, 'Pixy', 'Fereley' and 'St. Julien A') were studied in the region of Belgrade (Serbia). The average values for leaf surface, length and width, leaf petiole length and leaf shape index in cultivar/rootstocks combinations ranged from 40.08 cm² to 50.60 cm², from 9.12 cm to 10.43 cm, from 6.13 cm to 6.94 cm, from 1.74 cm to 2.71 cm, and from 1.37 to 1.58, respectively. The rootstocks had a statistically significant influence on the leaf surface, leaf width and leaf petiole length. Leaves of cultivar 'Cacanska Najbolja' had the highest average leaf surface, leaf length and width, while the cultivar 'Cacanska Rana' had the longest leaf petiole length. The meteorological conditions in the second year of the research influenced the highest values of the physical properties of leaf. Significant differences in chlorophyll *b* content and carotenoids were found among cultivars, rootstocks and cultivar/rootstock combinations, whereas differences in chlorophyll *a* content were not significant. The chlorophyll *b* content was the highest in leaves of 'Cacanska Najbolja' (46.77 µg/ml) and 'Cacanska Lepotica' (45.79 µg/ml), while the highest carotenoids contents were found in leaves of 'Cacanska Najbolja' (4.87 µg/ml) and 'Cacanska Rana' (4.79 µg/ml) cultivars. Differences among years in contents of chlorophyll *a*, chlorophyll *b* and carotenoids were found.

Keywords: *Prunus domestica* L., rootstock, cultivar, physical properties of leaf, content of leaf pigments.

OATS IMPORTANCE IN THE HUMAN FOOD

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Abstract

Oat is among the food crops and ancient grains cultivated and consumed worldwide. In Bosnia and Herzegovina, oats are used primarily as feed for horses and sheep. The decreasing use of draft animals (most notably horses) in agriculture and forestry has resulted in a decline in acreage planted to oats. In Bosnia and Herzegovina, there is not enough awareness of the beneficial effects oats have on human health, so this crop is used in the human diet sparingly, mostly in the form of bread, biscuits and flakes. Because it has a high concentration of well-balanced protein and a higher fat content of the grain than other cereals, the oat is considered to be the best quality small grain. Oats had gained a unique position, because of its diverse health benefits to the humans. The nutritional value of oat is mainly sustained by dietary fibers (DFs), which represent an essential part of the human diet. Oats also provide substantial levels of other bioactive compounds such as phenolic acids, tocopherols, sterols, avenacosides, and avenanthramides. DFs are comprised of several substances of plant origin, which are not digested in the human upper gastrointestinal tract. These include polysaccharides such as β -glucans in cereals, arabinoxylans, and cellulose. It is the major active compound in oats with proven cholesterol-lowering and antidiabetic effects. The consumption of oats has been determined to be beneficial for human health by promoting immunomodulation and improving gut microbiota. In addition, oat consumption assists in preventing diseases such as atherosclerosis, dermatitis, and some forms of cancer.

Keywords: *Dietary fibers, beta-glucan, speciality foods, human diet, health benefit.*

SIGNIFICANCE OF FERTILIZATION AND SOIL TYPE FOR THE DEVELOPMENT OF SUNFLOWER (*HELIANTHUS ANNUUS*)

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Abstract

Sunflower (*Helianthus annuus*) represents an important oil crop and may have a certain production potential under optimal input conditions. The study was conducted in a pot experiment with two soil types – Eutric Fluvisol and Pellic Vertisol with the aim to evaluate the effect of different norms and combinations of nitrogen, phosphorus, potassium, and silicon fertilizers and to estimate their impact on the vegetative development of the medium-early hybrid Sunflower (*Helianthus annuus* L.) – Sumiko HTS. The experiment included 15 fertilization treatments and one control variant, with three replications. Data was obtained on the height of the plants on the 34th, 47th, 57th and 67th day, from the beginning of the vegetation, as well as weights of fresh biomass from the above ground part and roots. According to the obtained experimental data, the agronomic characteristics were affected significantly by treatments. The optimal vegetative development was reached in the variants - N₂₀₀P₀K₁₄₀Si₈₀₀ and N₃₀₀P₈₀K₂₁₀Si₄₀₀ for the Eutric Fluvisol. In the other type of soil - Pellic Vertisol, respectively variants - N₄₀₀P₁₆₀K₁₄₀Si₈₀₀ and N₂₀₀P₀K₁₄₀Si₈₀₀, were those in which plant development was more favorably influenced by the applied fertilization. The analysis confirmed that the norm of 200 mg N/ pot, 140 mg K/pot in combination with 800 mg Si/ pot in both soil types, was the most appropriate for the growth of sunflower.

Keywords: *Fertilization rates, Nitrogen, Phosphorus, Potassium and Silicon fertilizers, Growth rate of sunflower biomass.*

EFFECT OF FERTILIZATION ON UPTAKE OF MACROELEMENTS WITH SUNFLOWER BIOMASS IN A POT EXPERIMENT WITH HAPLIC VERTISOL

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Abstract

The study was conducted in the conditions of pot experiment with Haplic Vertisol soil. The aim was to evaluate the effect of different norms and combinations of nitrogen, phosphorus, potassium and silicon fertilizers in the soil and their impact on the content and uptake of some main macro elements with sunflower biomass. The test culture was an early to medium-early hybrid Sunflower (*Helianthus annuus* L.) - Sumiko HTS. The experiment includes 16 variants of fertilization with 3 repetitions. Data are obtained on the yield of fresh and absolutely dry biomass from the above-ground part and the content of N, P, K, Si, Ca and Mg in the resulting dry biomass from plants. According to the experimental data obtained, the content and uptake of the examined macro elements with the sunflower biomass are significantly influenced by the imported norms and combinations of fertilizers. The highest is the uptake of nitrogen in the variants with the following norms: N200, N300 and N400. N uptake is the highest also in comparison with all other values of the examined elements. It is established that the changes in the macroelements uptake significantly follow changes in the quantities of the relevant elements in dry biomass in the variants of the experiment. With an increase in fertilization norms, not only the content of N, P, and Si is increased, but also the uptakes with sunflower biomass. This trend is expressed to a lesser extent with potassium.

Key words: *fertilizers, rates, export by sunflower biomass. "Helianthus annuus, L." and "macro elements uptake.*

IDENTIFICATION OF STORAGE ENDOSPERM PROTEINS WITHIN DURUM WHEAT CULTIVARS GROWN IN BULGARIA

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Abstract

Durum wheat is a traditional crop for Bulgaria, which has been grown in these lands since the time of the ancient Thracian tribes. The storage endosperm proteins – glutenins and gliadins, which form gluten, have significant effect on the qualitative parameters of *T. durum*. In this relation, by using the method of electrophoresis, the allele composition of the γ -gliadins, the high molecular (HMW-GS) and low molecular (LMW-GS) glutenins was studied in durum wheat cultivars grown in Bulgaria. Three alleles of HMW, coded for by loci *Glu-A1* and *Glu-B1* and six alleles of LMW, coded for by loci *Glu-A3* и *Glu-B3* were identified. The genotypes possessing gliadin subunits γ -42 (Malena) and γ -45 (Mirabel, Severina, Mirela and Melina) in locus *Gli-B1*, markers for poor and high gluten quality, respectively, were determined. According to their respective allelic forms in loci *GliB1/GluB3*, the studied accessions were divided into two main types (LMW-1 and LMW-2), on which the quality of the ground semolina from durum wheat depended. The quality scores and the genetic variability were calculated for the separate loci. The low value of the genetic variability index in locus *Gli-B1* was due to the high concentration of heritability potential in the γ -gliadin subunit 45, which is favorable for gluten quality. The obtained results showed that cultivars with LMW-2 type of the low-molecular weight glutenins were predominant in our study, which was due to the higher frequency of gliadin subunit γ -45.

Key words: *Triticum durum*, HMW-GS, LMW-GS, γ -gliadin, SDS-PAGE, A- PAGE.

SIGNIFICANCE OF FERTILIZATION FOR WINTER WHEAT DEVELOPMENT AND YIELD IN A FIELD EXPERIMENT ON ALLUVIAL MEADOW SOIL

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Abstract

The main objective of the study was to determine the influence of the main macro-elements: nitrogen (N), phosphorus (P), potassium (K) and silicon (Si) on the development of winter wheat, "Sadovo 1" variety and their optimal values in the conditions of field experiment on alluvial-meadow soil on the experimental field in Tsalapica, Plovdiv district. The distribution of the variants by plant height within the 175 days was in 6 homogeneous classes, while with increasing the vegetative development of wheat the differences between the variants decreased. Thus, within the 195 days there were 5 homogeneous classes, and when harvesting wheat on the 241 day, only 3 groups. All fertilizer variants fell into homogeneous class B and were significantly different from the control. The results show that the yield was influenced by the element potassium and the phosphorus-potassium interaction, while the interaction between nitrogen and silicon had practically no significant effect. The lowest yields were in the control variant, V9, homogeneous group **a**, and they were statistically different from all the other variants, while the highest yields were obtained in V7 (N₁₀₀P₁₆₀K₁₂₀Si₂₈), followed by V3 (N₁₀₀P₁₆₀K₆₀Si₂₈) and V4 (N₂₀₀P₁₆₀K₆₀Si₁₄). The increase in yields in the variants with fertilization relative to the control was high and ranged between 56 and 71%. According to the obtained data, the smaller norm of nitrogen (N100) was more efficient than N200 in the conditions of the 2021 year. The regularities established by the statistical processing of plant height during the wheat growing season were poorly correlated with grain yield data depending on the treatments of fertilization. Fertilization with SiO₂ did not prove to be very efficient in increasing plants yields, probably due to physico-chemical interactions with soil components and lack of enough time for dissolution and translocation in the test plants.

Key words: *macro-elements fertilization, field experiment, winter wheat, alluvial-meadow soil.*

SOILS OF THE SUDANO-SAHELIAN ZONES OF BURKINA FASO: TYPOLOGY, DISCRIMINATORY SOIL PARAMETERS AND AGRONOMIC POTENTIAL

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Abstract

Sudano-Sahelian agro-ecosystems are subject to severe land degradation that severely compromises crop yields, thus causing food insecurity for population. In order to determine the factors that compromise the productivity of these soils, a typology and the potential for agricultural production were established in the Sudano-Sahelian zone of Burkina Faso through a description of 16 soil pits. Also, sorghum-cowpea mixed cropping was conducted on these soils under simple zaï, zaï+organic substrate, zaï+Burkina phosphate and zaï+organic substrate+Burkina phosphate treatments. A factorial analysis of mixed data (AFDM) revealed the existence of three typological classes of soils, all belonging to the class of soils with ferric and/or manganese sesquioxides. According to equipotentialities and following the WRB (2015) classification, these soils would correspond to epipetric plinthosols, endo-petroplinthic lixisols and hypogleyic lixisols. The presence or not of gravelly horizon, carapace or ferruginous cuirass at depth, the intensity of drainage, the risk of waterlogging, the surface gravelly load, the depth and the distance of the test from the base of the slope are essential parameters that discriminate the soils on one hand. On the other hand, of retraction fissures, clay or sandy deposits, silt and clay content and C, N, P content are also parameters that differentiate these soils. Average yields of cowpea and sorghum under the treatments follow the established soil typology. The consideration of this soil typology is necessary to better orient the agronomic potential of the mixed cropping sorghum-cowpea crops.

Key words: *typology, sorghum-cowpea mixed cropping, discriminatory soil parameters, agronomic potential, Burkina Faso.*

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, reducing production costs. 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 sorghum population and climbing bean (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.*

YIELD COMPONENTS OF FOREIGN SUNFLOWER HYBRIDS IN EASTERN CROATIA

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Abstract

The grain yield of sunflowers is the most important goal of growing. Today, in the world and in the republic of Croatia, sunflower is the most often grown as an oil crop. The main yield components of sunflower are 1000-kernel weight, grain mass per head and the number of grains per head. Nowadays in Croatia only foreign hybrids of sunflower hybrids are represented on the market. Thus, the aim of this study was to determine the yield components of sunflower hybrids in 2020. In April 2020, 25 foreign hybrids of sunflower were sown at the experimental site of the Faculty of Agrobiotechnical Sciences Osijek. At the time of harvest 10 sunflower plants were collected from each sunflower hybrid, so that yield components were measured on 250 samples. The yield components measured in this study were plant height, 1000-kernel weight, heads diameter, grain mass per head and the number of grains per head. From the total number of analysed plants, about 25% of plants, or 62 plants, had an average stem height between 186.8 and 195.5 cm and 58 plants had a head diameter in the class of 18.4 to 19.8 cm. The number of seeds per head was also measured, so 55 plants had between 1,292 and 1,442 seeds per head, while 52 plants had very close, i.e. between 1,142 and 1,292 seeds per sunflower head. About 24% of the plants, i.e. 60 plants, had an average weight of seeds per sunflower head between 67.9 and 78.9 g per sunflower head. From the total number of analysed plants, 34 plants had an average mass of 1000 seeds between 54.7 and 60.6 g.

Keywords: *Yield components, Sunflower, Genotype, Seed, Height.*

THE POTENTIAL OF LED ILLUMINATION ON THE YIELD, MORPHOLOGICAL PROPERTIES AND COLORATION OF BROCCOLI MICROGREENS

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Abstract

As microgreens are increasingly grown as functional food, their cultivation technologies require optimization of factors such as temperature, light and humidity. Quality (wavelength) and photoperiod (duration) are the most important light factors that directly affect yield and morphological properties of plants. Photosynthetically active radiation (PAR) includes wavelengths in the range of 400-800 nm, whereby specific photoreceptors of plant cells absorb blue (400-500 nm), red (600-700 nm) and dark red (700-800 nm) wavelengths. The aim of this research was to determine the effect of supplemental LED's lighting with blue (450 nm), red (620 nm) and combination of blue and red spectrum (50:50) in the photoperiod of 14 h on the yield, morphological properties, pigments and colour content of broccoli microgreens. The research was conducted in a climate chamber with controlled conditions for plant cultivation (25 °C, 60% relative air humidity). Samples of broccoli microgreens were manually cut at the base of the hypocotyl in the cotyledon phenophase at a height of 7.5 cm after eight days. Microgreens of broccoli grown under LED supplementary lighting of blue spectrum and combination of blue and red spectrum showed higher yields (1198 g/m²) than samples grown under red spectrum (1046 g/m²). Broccoli microgreens grown under red spectrum had a longer hypocotil (69.7 mm) than samples grown under blue and combined spectrum. Samples grown under blue light treatment had larger leaf length (9 mm) than samples grown under red light treatment and combined light treatment. Most chlorophylls were accumulated under blue light (0.920 mg/l) as well as carotenoids (0.410 mg/l) and most colors were accumulated under combined light. Based on the results, it can be emphasised that growing microgreens under supplemental lighting (LED) has a positive effect on morphological parameters, yield and pigment content.

Keywords: *Brassica oleracea* L. var. *italica* Plenck, supplemental lighting, microgreens morphology, yield, chlorophyll content.

PRODUCTIVITY OF MAIZE (*ZEA MAYS* L.) AND NITROGEN USE EFFICIENCY IN RELATION TO LEVELS AND TIMING OF NITROGEN APPLICATION

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Abstract

Productivity of maize (*Zea mays* L.) and nitrogen use efficiency (NUE) as affected by levels and timing of nitrogen application were studied during 2019 and 2020 seasons at the Agriculture and Experiments Station, Faculty of Agriculture, Cairo University, Egypt. The experimental design was split plot in randomized complete block design in three replications. Nitrogen levels (122, 240, 288 and 336 kg N/ha) occupied the main plots and nitrogen timing (half at sowing and half before the first irrigation -T₁; half at sowing and half before second irrigation- T₂; and half before first irrigation and half before second irrigation -T₃) were allocated in sub plots. Results indicated that plant height, ear length, 100-kernel weight and ear and grain yields increased significantly with increase in nitrogen levels and the level of 336 kg N/ha observed significantly the highest values in both seasons. As regarding to timing of nitrogen application, maize yield characters namely plant height, ear length, kernels weight/ear and grain yield/ha were significantly affected among timing of nitrogen application where the highest values were recorded at T₃, while the lowest values were obtained at T₁ in both seasons. The interaction had significant effect on plant height in one season and on grain yield/ha in both seasons where the tallest plants and the highest yield were observed at 336 kg N/ha applied half at the first irrigation and half at second one. Moreover, NUE significantly decreased with increasing of nitrogen levels and significantly increased among timing of nitrogen application.

Key words: *Maize, nitrogen fertilizer levels and timing.*

RELATIONSHIP BETWEEN PHOSPHORUS STATUS AND NITROGEN FIXATION BY COMMON BEANS (*PHASEOLUS VULGARIS* L.) UNDER DRIP IRRIGATION

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Abstract

The current study aims to examine, the response of contrasted recombinant inbred lines of common bean to the application of phosphorus, to identify the bean recombinant inbred lines which were efficient in phosphorus utilization when dependent on nitrogen fixation as a source of nitrogen. The experiment was conducted at the experimental farm of Agricultural Research Station of the Nubaria district, Behera, Egypt, during the winter seasons of 2008–2009. Three levels of mineral phosphorus fertilizers were applied (0, 45 and 90 kg ha⁻¹ phosphorus pentoxide). Nodulation, plant growth parameters, leaf area, soil Olsen phosphorus, pH, and phosphorus and nitrogen of shoots, nodules and seeds were measured. The results have shown that the recombinant inbred lines responded positively to P application levels. The best values were observed in recombinant inbred lines 75, 83 and 34. Vegetative growth parameters were significantly enhanced by increasing levels of phosphorus. The highest level of phosphorus, i.e., 90 kg ha⁻¹ phosphorus pentoxide gave the optimal values of growth parameters for all common bean recombinant inbred lines while control plants obtained the lowest values. An increase of Olsen-P and a decrease of soil pH were also observed with increases in phosphorus. These results led to the conclusions that phosphorus applied to Nubaria soil: (1) improved the soil fertility; (2) enhanced the ability of root nodules of common bean recombinant inbred lines to fix atmospheric nitrogen; and (3) increased the release of hydrogen by roots, thus decreasing soil pH and reducing the immobilization of phosphorus in the soil solution and transforming it into available form for the plant.

Keywords: *Drip irrigation, Nitrogen fixation, Phosphorus, Phaseolus vulgaris, Recombinant inbred lines, Sandy soil.*

PERFORMANCE OF MAIZE (*ZEA MAYS L.*) AND ASSOCIATED WEEDS UNDER INTEGRATED WEED CONTROL MANAGEMENT

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Abstract

To study the performance of maize productivity and associated weeds under chemical and mechanical weed control, two field experiments were conducted at the Agricultural and Experiments Station, at Giza, Faculty of Agriculture, Cairo University, Egypt during the two summer seasons 2018 and 2019. Experiments were carried out in Randomized Completely Block Design (RCBD) with four replications and six treatments constituting 24 plots. These six treatments were: Control (weedy check), atrazine alone, one hand hoeing after 15 days from sowing (DAS), two hand hoeing (15 and 30 DAS), atrazine + one hand hoeing and atrazine + two hand hoeing. At 90 DAS, weeds grown in one square meter were taken at random from each plot. Classification of weeds to broad-leafed and grassy and dry weight of each was recorded separately and weed control efficiency was also determined. At harvest, plant height, ear length, ear yield and grain yield (t/ha) were estimated. The present results indicated that the herbicide applied treatments in combinations with two hand hoeing at 15 and 30 DAS registered significantly lower total weed dry matter production (40.1 and 49.0 g/m²), higher weed control efficiency (61.0 and 59.5%) and higher grain yield of maize (6.1 and 5.9 t/ha) as compared with other treatments in both seasons, respectively. Therefore, the loss in maize grain yield vary from 26 - 49% when weeds are not sufficient controlled.

Key words: *Maize, weed, chemical and mechanical weed control.*

IDENTIFICATION OF GENOMIC REGIONS ASSOCIATED WITH AGRONOMICAL TRAITS OF BREAD WHEAT UNDER TWO LEVELS OF SALINITY USING GWAS

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Abstract

Soil salinity is a major environmental stress that adversely affects the growth, development, productivity and quality of crop species, in particular, in arid and semi-arid regions. Identification of chromosomal regions associated with agronomic traits under salinity stress is crucial for improving salinity tolerance in wheat. GWAS and structure analyses were employed to evaluate 289 elite lines of the Wheat Association Mapping Initiative (WAMI) population under low (LS) and high (HS) salinity conditions using 15,737 SNP markers and seven agronomical traits. Evaluated genotypes responded differently to the different environments in all measured phenotypic traits, highlighting genetic diversity within the WAMI population in response to salt stress. Heritability degree ranged from moderate (37%) to high (88%). GWAS identified 118 and 120 significant associations between SNP markers and seven evaluated phenotypic traits under LS and HS conditions, respectively. Significant association of some markers with more than one phenotypic trait was observed, indicating possible pleiotropic or indirect effects. A high degree of significant linkage disequilibrium (>52%) was observed among SNP markers on different chromosomes, indicating epistatic interaction. The salt stress index (STI) exhibited a positive significant correlation to grain yield per plant (GYP) under both LS and HS conditions ($R^2=0.851-0.856$). A linear regression between STI and GYP under HS conditions (GYPs) was identified, suggesting that STI is the best tolerance index for predicting high-yielding genotypes. The results present the WAMI population as a valuable source for improving yield potential for salt tolerance in wheat. Furthermore, our findings emphasize that GWAS is a powerful tool in promoting wheat breeding through accurate identification of molecular markers significantly associated with agronomic traits, which is essential for marker-assisted breeding.

Keywords: *Triticum*; Salt stress; Salinity; Tolerance index; Association analysis; QTL

EFFECTS OF COMPOST APPLICATION RATES AND MULCH THICKNESS ON TOMATO YIELD UNDER SALT AFFECTED SOIL OF EAST SHEWA OROMIA NATIONAL REGIONAL STATE, ETHIOPIA

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Abstract

Studies were conducted as on-farm trials at East Showa Dugda District, Girisa Kebele to evaluate the effect of different compost application rates (0, 2, 4 and 6 ton/ha) and mulch thickness (0 cm/ha, 5 cm/ha, 10 cm/ha, and 15 cm/ha) on soil physicochemical properties and crop performance in terms of yield of *Solanum lycopersicom*. L Production. The experiment was conducted in factorial experiment arranged in a randomized complete block design with three replications. The analysis of variance showed that, all the main effects of the growth parameters showed significant effects except mulch thickness on plant height. The result of Some yield and yield component variables (number of fruit per plan, were significantly affected by the interaction effects of mulch thickness and compost application rate. Marketable fruit yield was significantly affected by the level of compost and its interaction with mulches. Yield obtained from the treatment combination of 6 ton/ha compost rate and 10 cm mulch thickness was ergonomically and economically remunerative by 15.56% for farmers. The optimum fruit yield was 37.23t/ha found on 6t/ha compost and 10cm mulch plot .All the yield and yield components indicated significant difference. In general, the yield obtained from the 6ton/ha compost rate and 10cm mulch thickness makes farmers' benefited weather for consumption or market purpose

Key words: *salt affected soil, soil amendment, soil properties, yield, and Solanum lycopersicom*. L

EXPLORING AN INVASIVE PLANT *SOLIDAGO CANADENSIS* AS THE POTENTIAL SOURCE OF TRITERPENOIDS

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Abstract

Canadian goldenrod (*Solidago canadensis* L.) is a perennial herb introduced from North America and widely distributed in most European countries, often regarded as an invasive plant threatening the native species, simultaneously being a hard-to-control weed in agriculture. Nevertheless, due to its application in traditional herbal medicine (as *Solidaginis herba*), *S. canadensis* also constitutes a cheap and readily available medicinal raw material. The content of such metabolites as flavonoids, polysaccharides, diterpenes and triterpenoid saponins in this plant is well characterized, whereas the data on the occurrence of triterpenoids and steroids in a free (not conjugated) form are scarce. Thus, the present study was aimed toward the gas chromatography-mass spectrometry (GC-MS) analysis of the extracts obtained from inflorescences (branched panicles) and leaves of *S. canadensis*. Diethyl ether extracts were obtained from dried and powdered samples of *S. canadensis* leaves and inflorescences divided into flowers and stems. Analysis was made by gas chromatography-mass spectrometry method (GC-MS). In both inflorescences and leaves, the significant contents of triterpenoids belonging to lupane-, oleanane- and ursane- groups were found, i.e., lupeol acetate, β -amyirin, and α -amyirin accompanied by its ketone, α -amyrenone. Flowers were the richest source of triterpenoids (approx. 1.2 mg/g of dry weight), whereas the contents in leaves (0.91 mg/g d.w.) and inflorescence stems (0.69 mg/g d.w.) were lower. In all analyzed extracts one compound belonging to plant Δ^7 -sterols, spinasterol, was found, present mainly as an ester conjugate.

Keywords: *Canada goldenrod, invasive plants, Solidago canadiensis, steroids, triterpenoids*

EVALUATION OF A MEDICINAL PLANT *ECHINACEA PURPUREA* IN TERMS OF STEROID AND TRITERPENOID CONTENT

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Abstract

Purple coneflower (*Echinacea purpurea* (L.) Moench) is a widely known medicinal plant applied in herbal medicine. The phytochemical characterization of *E. purpurea* includes mainly the content of alkaloids, phenolics, sesquiterpenoids or saponins; meanwhile, the composition of other groups of bioactive constituents, i.e., steroids and triterpenoids occurring in this plant in a free (not conjugated) form has been less studied. Therefore, the aim of the present work was the analysis of steroids and triterpenoids in the aerial parts (inflorescences and leaves) of *E. purpurea*. Diethyl ether extracts were obtained from dried and powdered samples of *E. purpurea* leaves and two separate parts of the inflorescence heads, i.e., external ray (ligulate) florets, and the internal receptacles containing disc (tubular) florets. Analysis was made by gas chromatography-mass spectrometry method (GC-MS). Apart from the typical sterols (cholesterol, campesterol, sitosterol, stigmasterol), other compounds as steroid ketones (sitostenone, tremulone, stigmastanedione) and biosynthetic intermediates of steroid pathway (cycloartanol, cycloeucalenol, 24-methylenecycloartanol) were identified. Leaves and ligulate flowers were particularly rich in steroids (approx. 0.97 and 0.95 mg/g of dry weight, respectively), however, the quantitative profile of individual compounds differed significantly, e.g., sitosterol followed by stigmasterol were the most abundant in leaves, whereas cycloeucalenol and cycloartanol were predominant in ligulate flowers. In comparison to leaves and ligulate flowers, the steroid content of tubular florets was lower (0.63 mg/g d.w.) and the composition of these compounds was relatively simpler. Triterpenoids were minor compounds in *E. purpurea* extracts, oleanane- and ursane-type alcohols and acids were found mainly in leaf extracts.

Keywords: *Echinacea purpurea*, purple coneflower, steroids, triterpenoids.

EFFECTS OF BIOSTIMULATORS ON GROWTH OF TOMATO PLANTS CULTIVATED UNDER PROTECTED AND FIELD CONDITIONS

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Abstract

Biostimulators can be used in order to stabilise plant growth in even unfavourable climate conditions or fluctuating conditions in the rhizosphere and they stimulate the process of the formation of plant-organs making the plants resistant to diseases and viruses. In our investigations with tomato plants, liquid substances based on different organic compounds such as lignite coal (Humates), waste of food production (Lactate), algaeas (Megafol), plant-based substances (Čudomiks,) and microorganisms such as *Bacillus subtilis* were used as biostimulators. The effects of biostimulators were investigated in tomato soilless cultivation, cv. Ferrari RZ, in the greenhouse of the experimental station in Berlin. Humates, lactates, and *B. subtilis* were added to the nutrient solution, single or mixed and well sprayed on the leaves. Humates improved plant growth even when the EC was very high. In the case of extreme pH values of 4.5 or 7.5 better growth parameters were recorded when lactate had been added to the nutrient solution. In some cases, the development of tomato plants was also enhanced by combinations of humates, lactates, and *B. subtilis*. The field experiment was carried out on grey-red soil in the valley of the river Raša (Istria). Biostimulators were applied on indeterminate, high beef tomato variety 'Signora F1' with a training system on one or two branches. PE mulch foil, fertigation, and trellis were used on the plantation. The influence of the triple treatment on fruit number, individual fruit weight, yield distribution, time of disease onset, and branch length was examined. The results of the study show that growing with two side shoots and treating with Megafol is the superior combination in terms of yield. On the other hand, the cultivation form with one side shoot in combination with Megafol leads to a better distribution of yields.

Keywords: *Solanum lycopersicon L.*, *Humates*, *Lactates*, *Bacillus subtilis*, *Megafol*.

ASSESSING THE GENETIC DIVERSITY OF COWPEA [VIGNA UNGUICULATA (L.) WALP.] NOVEL COWPEA BREEDING LINES USING PHENOTYPIC AND MICROSATELLITE MARKERS

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Abstract

Sustainable production of cowpea is anchored on continuous improvement of cultivars through breeding and selection of desirable genetic traits. This study aimed to assess the phenotypic and genetic variations among cowpea progenies from a half-diallel crossing scheme involving a landrace parental donor, GH3684 and four parental recipients (IT97K-499-35, SARC-1-57-1, PADI-TUYA, UCS01) to identify superior breeding lines. F₄ progenies and parental genotypes (55) were evaluated on the field in three replications based on randomized complete block design. The quantitative data were subjected to analysis of variance and correlation. Principal component and cluster analysis involved both quantitative and qualitative parameters. There were significant variations ($P < 0.05$) in morphological and yield parameters among the cowpeas. The 100 seed weight differed significantly ($P < 0.05$) among the cowpea breeding lines, ranging from 11 to 26.8 g with a mean of 20.4 g. UC15-36, UC15-46, UC15-06 and UC15-51 had the highest average 100 seed weights of 25.8 g, 24.8 g, 24.7 g and 24.0 g, respectively. UC15-12 produced the highest grain yield of 2.7 t ha⁻¹ and proved superior to the parental genotypes. On the whole, 42 % of the cowpea progenies had improved agro-morphological traits for selection to advance the breeding lines.

Keywords: *Breeding, Genetic, Genotypes, Phenotypic, Progenies, and variability*

GROWTH OF MEDITERRANEAN SAGE SPECIES AND INTERSPECIFIC HYBRIDS UNDER LIMITED IRRIGATION IN A GREEN ROOF

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Abstract

Mediterranean sages (*Salvia* spp.) could be ideal for use in xeriscaping, as bee-friendly plants or in green roofs. *Salvia fruticosa*, *S. officinalis*, *S. pomifera* ssp. *pomifera*, *S. ringens* and *S. tomentosa*, along with five new interspecific hybrids of them, were evaluated for their growth under regular (every 2–3 days when substrate moisture 17–23% v/v) and limited irrigation (every 4–5 days when substrate moisture 7–13% v/v), in a Mediterranean extensive green roof. A substrate (grape-marc compost: perlite: pumice, 3:3:4, v/v), with 10 cm depth, was used. *S. pomifera* ssp. *pomifera* × *S. ringens* and *S. officinalis* × *S. pomifera* ssp. *pomifera* survived at the highest percentage. Limited irrigation resulted in the reduction of aboveground and root biomass of all sage types, but to varying degrees depending on sage type. *S. officinalis*, *S. officinalis* × *S. ringens* and *S. pomifera* ssp. *pomifera* × *S. ringens* showed the lowest aboveground biomass reduction, in contrast to *S. fruticosa* that showed the highest, while *S. officinalis*, *S. ringens*, *S. officinalis* × *S. pomifera* ssp. *pomifera* and *S. pomifera* ssp. *pomifera* × *S. ringens* showed the lowest reduction in root biomass. All studied sage types, with a reservation for *S. fruticosa*, grew satisfactorily under limited irrigation, being suitable for sustainable exploitation in xeriscaping, including extensive green roofs in arid regions. Especially the hybrids of *S. officinalis* or *S. ringens* or *S. pomifera* ssp. *pomifera* were found to be even more resistant to limited irrigation than their parental species.

Keywords: *Salvia fruticosa*, *Salvia officinalis*, *Salvia pomifera* ssp. *pomifera*, *Salvia ringens*, *Salvia tomentosa*

EFFECT OF SEASON IN ROOTING STEM-TIP CUTTINGS OF MEDITERRANEAN SAGES (*Salvia* spp.) NATIVE TO GREECE

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Abstract

Mediterranean sages (*Salvia* spp. family Lamiaceae) are readily propagated by stem cuttings. However, their rooting efficiency may be affected by season because of differences in mother plant physiology and climatic conditions. In the present study, stem-tip cuttings of *Salvia fruticosa*, *S. officinalis*, *S. pomifera* ssp. *pomifera*, *S. ringens* and *S. tomentosa*, 8-12 cm long, were collected from greenhouse grown mother plants at the end of November 2020, February, May and August 2021, indicative of four seasons. The aim was to define the most appropriate period for effective rooting of cuttings for each species that could enhance their potential use in floriculture industry through the regeneration of selected genotypes. Cuttings were treated with dusting powder for soft wood cuttings Rhizoapon (0.5% w/w IBA) and were placed for rooting on peat-perlite substrate 1:1 (v/v) in a mist for 2 weeks. Then, they remained on the greenhouse bench in a semi-shaded bench for another 4 weeks. Cuttings of all species rooted more efficiently during the period from autumn to spring, excepting *S. fruticosa*, whose cuttings rooted at the lowest percentage in spring, probably because of insufficient lignification, while they presented high rooting percentage in summer similar to that of autumn and winter. Therefore, propagation of studied *Salvia* spp. by stem-tip cuttings was feasible throughout the year, although rooting percentages were reduced during spring (for *S. fruticosa*) and summer (for all species, excepting *S. fruticosa*). By choosing the appropriate season maximum rooting percentages of cuttings can be achieved.

Keywords: *Salvia fruticosa*, *Salvia officinalis*, *Salvia pomifera* ssp. *pomifera*, *Salvia ringens*, *Salvia tomentosa*.

SELECTION IN THE ABSENCE OF COMPETITION OF HIGH-YIELDING INBRED LINES OF RUNNER BEAN UNDER HEAT STRESS

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Abstract

Selection in the absence of competition under ultra-low density within promising landraces has been proposed as a mean to develop new cultivars serving the needs of a sustainable agriculture under diverse climatic conditions. Runner bean (*Phaseolus coccineus* L) is a climbing plant of indeterminate growth type cultivated for dry seeds mostly at mid –high elevations of Greece. It is the second most economically important bean crop after *P. vulgaris* L. with a high ability to tolerate cool climates. The present study aimed to investigate the performance of six inbred lines derived from a single plant selection among ultra spaced individuals of a runner bean landrace named “Loggas” from central Greece (Thessaly). These lines along with the initial landrace as a check were evaluated in a honeycomb R-7 experiment in northern Greece (Florina), during 2021. At the initial plant reproductive phases, anthesis and pod growth, a severe heat stress was observed. High day and night temperatures caused shedding of flowers and young pods reducing thus pod and seed production. The progeny lines under these diverse conditions outperformed the original landrace showing an increase in the total number of pods up to 27%, the number of pods reaching maturity up to 64%, in seed weight up to 53% and in the weight of mature seeds up to 74% in the absence of competition. Further research is under way for a final evaluation of the selected progenies under farming density.

Keywords: *Runner bean, Heat stress, Progeny lines, Absence of competition.*

QUALITY CHARACTERISTICS OF DIFFERENT INBRED LINES OF BEAN CULTIVARS UNDER WATER STRESS

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Abstract

The purpose of this work was to evaluate the qualitative characteristics of different inbred lines of common bean (*Phaseolus vulgaris* L.) cultivated in two different irrigation treatments (normal and reduced irrigation) and in farming density conditions in an RCB experiment with three replications in 2020. The progeny lines originated from individual high (HY) and low-yielding (LY) plants of second-generation lines of the determinate type bean varieties Iro, Pirgetos and Lingot Suisse selected in honeycomb design trials under normal and deficit irrigation treatments during the 2019 growing season. Hydration%, seed coat%, ash%, protein, fibrous substances and fat concentration and cooking time were determined. Under water stress there was a statistically significant increase in hydration%, protein concentration, fiber% and cooking time compared to the normal irrigation treatment for almost all genotypes evaluated. Ash concentration was significantly higher under full irrigation whereas fat% and seed coat% were not affected by water stress. Although the genotypes differed significantly for almost all quality characteristics evaluated except ash% and cooking time when the HY inbred lines were compared with the original variety from which they originated during the initial selection, they had similar behavior regarding seed quality traits in both normal and reduced irrigation compared to the original genotypes. Furthermore, most of the HY inbred lines had significantly higher yield than the original genotypes in both irrigation treatments thus providing evidence that intracultivar selection for high-yielding ideotypes under adverse conditions is feasible without degrading quality traits.

Keywords: *Dry bean, Water stress, High yielding lines, Seed quality traits.*

EVALUATION OF DIFFERENT INBRED LINES OF BEAN CULTIVARS UNDER WATER STRESS

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Abstract

Common bean (*Phaseolus vulgaris* L.) is one of the most significant pulses in Greece with increased cultivated areas in recent years. In 2019, individual high (HY) and low-yielding (LY) plants of second-generation lines of the determinate type bean varieties Iro, Pirgetos and Lingot Suisse were selected in R21 honeycomb design trials under normal and deficit irrigation treatments. In 2020, ten single plant inbred lines together with the three original varieties (three HY and one LY line from Pirgetos, four HY and one LY line from Iro and one HY line from Lingot Suisse) were evaluated in a randomized complete block design experiment with three replications at farming density under full and 50% irrigation. Days to start of flowering and plant height were not affected by the low irrigation treatment but there were statistically significant differences between the different genotypes. Water stress significantly reduced the number of pods plant⁻¹ and the yield of all genotypes studied, from -14.86% to -35.04%, but without a statistically significant difference between the genotypes. When the HY inbred lines were compared with the original variety from which they originated during the initial selection, they had much better behavior in both normal (from +4,32% up to +30,91%) and reduced irrigation (from +6,88% up to +40,04%) compared to the original genotypes. These superior lines will be further evaluated in different environments with the aim to identify and develop improved genotypes which could perform better under adverse conditions.

Keywords: *Dry bean, Water stress, High yielding lines, Normal density.*

OVER-ENVIRONMENT AGRONOMIC EVALUATION OF DURUM WHEAT VARIETIES FOR SUSTAINABLE PRODUCTION

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Abstract

Wheat products contribute about 20% of the protein and calories in the human diet. The cultivation of durum wheat (*Triticum turgidum* L. var. *durum*) is particularly important for the countries of the Mediterranean basin, where the main part of its cultivation is concentrated worldwide. In Greece, durum wheat ranks second based on cultivated area, which in the last 30 years varied from 0.2 to 0.35 million ha. It is also a particularly important product in Greece, due to its use in domestic industry and its highly exportable product. A selection of more than 80 varieties are commercially available for growers. There is a limited information for the over-location evaluation of productivity and quality of these varieties. The aim of this work was the over-environment evaluation of 15 commercial varieties of durum wheat in four different environments of Central Macedonia-Greece, which is one of the most important regions in the cultivation of durum wheat. The experimental design was a randomized complete block design with four replications and the plot size was 12m². Yield, plant height, earliness, as well as other agronomic, physiological and quality characteristics were recorded, and the genotypes were evaluated according to these characteristics. Varieties with high yield, good quality and general adaptability to the evaluation environments were identified. The results could contribute to higher productivity and more stable production of durum wheat in Central Macedonia-Greece, leading to an increased income for the farmers.

Keywords: *Yield, Adaptability, Over-location evaluation.*

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: T2EDK-01244-GrWheat).

EVALUATION OF COMMERCIAL DURUM WHEAT (*TRITICUM TURGIDUM* L. VAR. *DURUM*) CULTIVARS IN DIFFERENT NITROGEN FERTILIZATION TIMING

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Abstract

The cultivation of durum wheat is particularly important for Greece, as it covers an area of 0.2 - 0.35 million ha. Durum wheat contributes significantly to the uptake of protein and calories in the human diet. The main quality characteristic of durum wheat is the protein content, which is related to nitrogen fertilization. The purpose of this work was to evaluate 15 important commercial varieties of durum wheat for production and quality characteristics, in different N fertilization applications. The experiments were conducted at the farm of the Institute of Plant Breeding and Genetic Resources, in Thessaloniki-Greece during the 2021-22 cultivation period. The experimental design had two factors with four replications and an experimental plot of 12m². The first factor was the top-dressed application of the same N rate (one-dose or split in 2-times), and the second was the 15 varieties. Yield, plant height, earliness as well as other agronomic, physiological and quality characteristics were recorded. Differences between cultivars were found for most traits, while it was identified for cultivars where differential fertilization increased protein content. The outcome of this experiment will help farmers with the proper selection of cultivar and nitrogen fertilization in order to succeed increased productivity of this high-quality product.

Keywords: *Yield, Protein, Cultivar, Nitrogen.*

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: T2EDK-01244-GrWheat.)

GROWING DEGREE-DAYS METHOD FOR PREDICTING ANTHESIS DATE OF SUNFLOWER (*Helianthus annuus*) UNDER GREEK CONDITIONS

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Abstract

Growing Degree Days (GDD) have been used extensively to predict development stage and anthesis dates of globally important crops such as sunflower (*Helianthus annuus*). The most common mathematical formula used to calculate daily GDD is $GDD = T_{aver} - T_{base}$, where T_{base} is the base temperature (°C), $T_{aver} = 0.5 \cdot (T_{max} + T_{min})$, T_{max} and T_{min} are the daily maximum and minimum temperature (°C). Researchers have proposed thresholds on the formula variables outside which there is no biological impact, resulting in different methods of GDD calculation and different results. The methods that have been proposed are: i) if T_{aver} is outside the range set by T_{base} and T_{upper} temperature thresholds, to be equal to the nearest threshold, ii) if T_{max} or T_{min} are outside the range set by T_{base} and T_{upper} temperature thresholds, to be equal to the nearest threshold, iii) if T_{aver} is lower than T_{base} to set equal to T_{base} and iv) if T_{max} or T_{min} are lower than T_{base} to set equal to T_{base} . In this work we tested these methods to evaluate their performance in predicting sunflower flowering dates in Greece for various T_{base} and T_{upper} . The data used comprised to daily T_{max} and T_{min} , from 10 sunflower growing periods in Central Greece, from crop emergence to flowering. The least Coefficient of Variation (%CV) of accumulated degree days until flowering was used as a performance criterion. The results showed that there must be an upper and lower temperature threshold, and the values best predicting sunflower anthesis were $T_{base}=4$ °C and $T_{upper}=30$ °C.

Keywords: *Sunflower (Helianthus annuus), Growing Degree Days (GDD), development stage of crop, Greece.*

**MORPHOLOGICAL ANALYSIS IN NEW INTERSPECIFIC HYBRIDS OF SALVIA
SPP. ORIGINATED FROM *S. FRUTICOSA*, *S. OFFICINALIS*, *S. POMIFERA* SSP.
POMIFERA AND *S. RINGENS***

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Abstract

The introduction of new hybrids and clones suitable for xeriscaping is a challenge for modern floriculture. The Mediterranean sages *Salvia ringens* and *S. pomifera* ssp. *pomifera* are unexploited versus *S. officinalis* and *S. fruticosa* that are widely used in floriculture and medicinal industry. The present study was conducted to test quantitative and qualitative morphological traits to find suitable descriptors for the discrimination of new *Salvia* hybrids. Morphological characteristics were used to study new hybrids, i.e., OR (*S. officinalis* × *S. ringens*), FR (*S. fruticosa* × *S. ringens*), PR (*S. pomifera* ssp. *pomifera* × *S. ringens*). A total of eight quantitative (leaf and flower/inflorescence morphometrics) and 14 qualitative characters (characters of vegetation, flowers and fragrance) were selected and used based on descriptors for other plant species. One way ANOVA was used for determination of the differences between the mean values of leaf, stem and flower traits and a dendrogram was generated based on the genetic distance matrix. *S. ringens* inherited its segmented leaves and their light aroma to all its hybrids. PR and FR hybrids formed leaves and inflorescences with intermediate length between their parents, while the inflorescence length of OR had no difference with *S. officinalis*. The present study suggests morphological characteristics to differentiate the new hybrids from their parents in order to enhance their introduction to the floricultural industry.

Keywords: *Dendrogram, descriptors, flower morphometrics, Mediterranean sage, leaf morphometrics, qualitative and quantitative characters.*

MORPHOLOGICAL CHARACTERS OF NEW INTERSPECIFIC HYBRIDS OF SAGE ORIGINATED FROM *SALVIA OFFICINALIS*, *S. POMIFERA* SSP. *POMIFERA* AND *S. TOMENTOSA*

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Abstract

Native plant species or clones are an important source of new products for the floricultural industry. Greek flora is a bank of genetic material due to its biodiversity and includes *Salvia* spp. of high potential value, which have not been exploited like other commercial species. The present study aims to reveal the morphology of two new interspecific hybrids, between *S. officinalis* and *S. pomifera* ssp. *pomifera* or *S. tomentosa*, i.e. *S. officinalis* × *S. pomifera* ssp. *pomifera* (OP) and *S. officinalis* × *S. tomentosa* (OT). A total of eight quantitative and 14 qualitative characters were selected and used based on descriptors for other plant species. The first group of characters involved leaf and flower morphometrics and the second characters of vegetation, flowers and fragrance. One way ANOVA was used for determination of the differences between the mean values of leaf and flower traits and a dendrogram was generated based on the genetic distance matrix. OP and OT hybrids found to be closer to *S. officinalis*. Both *S. officinalis* and *S. pomifera* ssp. *pomifera* are strongly aromatic plants and their hybrid has a pleasant distinctive aroma, which is slightly closer to the aroma of *S. pomifera*. OT is a compact plant with numerous lateral shoots and a lighter aroma than that of *S. officinalis*. The present study revealed morphological characteristics to differentiate the new hybrids.

Keywords: *Dendrogram, descriptors, flower morphometrics, Mediterranean sage, leaf morphometrics, qualitative and quantitative characters.*

A FIRST STUDY ON FLOWER MORPHOLOGY OF SIX *ARBUTUS* SPECIES, ONE HYBRID AND ONE CULTIVAR OF THE MEDITERRANEAN BASIN AND NORTH AMERICA

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Abstract

Three Mediterranean *Arbutus* species and their natural hybrid, as well as three North American species and one Californian cultivar of mysterious origin were studied microscopically; a comparison of the internal anatomy of the flowers of these species is reported for the first time. Morphological features were found to be similar in general but unique to the *Arbutus*. However, the length of the anther appendages, the spurs, seems to provide a heritage trait linking the Californian cultivar 'Marina' to the *A. canariensis* and support other morphological findings between the East Mediterranean hybrid, *A. × andrachnoides*, and its parents *A. andrachne* and *A. unedo*.

Keywords: *Anther appendages, blossom, spur, strawberry tree.*

IRRIGATION AND NITROGEN FERTILIZATION EFFECT ON CHAMOMILE PRODUCTION IN EAST THESSALY

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Abstract

Chamomile (*Matricaria chamomilla* L.) is an annual plant which belongs to *Asteraceae* family. Its flower heads and the essential oil are used for medical purposes. The purpose of this study was to investigate the effect of irrigation and nitrogen fertilization on chamomile's flower heads production. Thus, chamomile was sown in the experimental farm of the Department of Agriculture, Crop Production and Rural Environment of the University of Thessaly, based in Velestino area, in December 2020. There was used a split-plot design, with irrigation comprises the main factor (I_1 : 0 mm, I_2 : 54 mm), and N-fertilization the sub-factor (N_1 : 0 kg ha⁻¹, N_2 : 70 kg ha⁻¹, N_3 : 140 kg ha⁻¹, N_4 : 210 kg ha⁻¹) in four repetitions. To determine the effect of the studied factors, three harvests were carried out. Irrigation was found to have a critical effect, increasing the total harvested yield in fresh and dry weight (I_1 : 6.55 t ha⁻¹ - 1.61 t ha⁻¹, I_2 : 9.59 t ha⁻¹ - 2.30 t ha⁻¹). Regarding nitrogen fertilization, maximum yield in dry flower heads weight was recorded by the maximum nitrogen fertilization (N_4 : 2.12 t ha⁻¹). In the case of the interaction the higher yield in dry weight was measured in the case of irrigated and fertilized under 140 kg ha⁻¹ (I_2N_3 : 2.51 t ha⁻¹). Therefore, it could be concluded that chamomile can produce high yields under supplementary irrigation and nitrogen fertilization which can lead to almost double yield.

Keywords: *Matricaria chamomile*, irrigation, nitrogen, yield, aromatic-pharmaceutical plants.

UNDER REDUCED IRRIGATION IN A GREENHOUSE AND AN EXTENSIVE GREEN ROOF

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Abstract

Tolerance in xerothermic conditions of the new interspecific sage hybrid *S. officinalis* × *S. ringens* was examined aiming to its exploitation in extensive green roofs and xeriscaping. Two irrigation frequencies, a regular (every 2–3 days, when substrate moisture 17–23% v/v) and a reduced (every 3–5 days, when substrate moisture 7–13% v/v) were applied in a greenhouse (cultivation in 14 cm pots on peat: perlite, 2:1, v/v) and a green roof experiment (cultivation in 10 cm deep substrate mixture of grape-marc compost: perlite: pumice 3:3:4, v/v, alongside with the parental species, *S. officinalis* and *S. ringens*). Both experiments started in April 2021 and lasted 3 and 5 months, respectively. In the greenhouse, most growth parameters of the hybrid, i.e., plant height, lateral shoot number and length and aboveground dry weight were not affected significantly by reduced irrigation, excepting root dry weight which was reduced. In the green roof, *S. officinalis* × *S. ringens* had higher plant height and aboveground dry weight than the parental species. Under reduced irrigation, all *Salvia* types had lower plant diameter, as well as aboveground and root dry weight compared to regular irrigation. *S. officinalis* × *S. ringens* hybrid, as well as its parental species *S. officinalis* and *S. ringens* grew satisfactorily under reduced irrigation, resulting to their recommendation for sustainable use in xeriscaping, including extensive green roofs.

Keywords: *drought resistance, Mediterranean sage, interspecific hybrid, Salvia officinalis, Salvia ringens.*

GROWTH OF THE NEW *Salvia officinalis* × *S. tomentosa* HYBRID UNDER REDUCED IRRIGATION IN GREENHOUSE AND GREEN ROOF CONDITIONS

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Abstract

Aiming to the exploitation of a new interspecific Mediterranean sage hybrid *Salvia officinalis* × *S. tomentosa*, along with its parental species *S. officinalis* and *S. tomentosa*, in extensive green roofs and xeriscaping, their resistance to xerothermic conditions was examined in a Mediterranean green roof and in a greenhouse under regular and reduced irrigation. In the green roof the hybrid and the parental species were grown on 10 cm deep substrate mixture of grape-marc compost: perlite: pumice 3:3:4, v/v, while in the greenhouse in 14 cm plastic pots, on peat: perlite 2:1, v/v. Planting took place in April 2021 and the experiment lasted 3 and 5 months, in the greenhouse and green roof, respectively. Two irrigation frequencies, a regular (every 2–3 days when substrate moisture 17–23% v/v) and a reduced (every 3–5 days when substrate moisture 7–13% v/v) were applied. In the greenhouse, the hybrid growth was very satisfactory under reduced irrigation, since only plant height was reduced from all growth parameters recorded (lateral shoot number and length, aboveground and root dry weight). In the green roof, *S. tomentosa* had higher plant height and diameter and aboveground dry weight than *S. officinalis* and their hybrid, while root dry weight was higher in the parental species compared to the hybrid. Reduced irrigation resulted in significant reduction of all growth parameters of all *Salvia* types. However, their growth remained satisfactory. So, both the hybrid and its parents are recommended for sustainable use in xeriscaping, including extensive green roofs.

Keywords: *drought resistance, Mediterranean sage, interspecific hybrid, Salvia hybrid, S. officinalis, Salvia tomentosa*

THE EFFECT OF CYTOKININ TYPE AND CONCENTRATION ON *IN VITRO* MULTIPLICATION OF *SALVIA FRUTICOSA*

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Abstract

Salvia fruticosa Mill. (Lamiaceae), Greek sage, is a perennial sage species endemic of the Mediterranean region, part of the macchia vegetation, with a wider distribution from Sicily to Israel. Aiming to improve and promote the species for ornamental and medicinal use, in the present work the effect of cytokinin type and concentration on its *in vitro* propagation was studied. 6-benzyladenine (BA), zeatin (ZEAT) or meta-Topolin (mT) at 0.0, 0.4, 0.8, 1.6 or 3.2 mg L⁻¹ were combined with 0.01 mg L⁻¹ 1-naphthaleneacetic acid (NAA) in the culture medium (solid MS). Shoot tip or single-node explants from microshoots originated from explants excised from *in vitro* grown seedlings were used. The response for shoot production was very high in shoot tip explants (over 90%) in most media, while in nodal explants was slightly lower (75-85%) when the medium was supplemented with ZEAT or BA. The presence of cytokinin compared to the hormone-free medium promoted slightly the number of shoots produced decreasing simultaneously their length. However, cytokinin in high concentrations, regardless of cytokinin type, resulted in the formation of hyperhydrated shoots, which reached up to 62% in the substrate with 3.2 mg L⁻¹ ZEAT. There was an indication that most normal shoots (2.4-2.5 shoots explant) were produced on 0.8 or 1.6 mg L⁻¹ BA medium from nodal explants, while the highest multiplication rate was observed on 0.8 mg L⁻¹ mT medium. The increase in concentration of all three types of cytokins tested resulted in an increase in the number of shoots produced, but this increase was mainly reflected in hyperhydrated shoots.

Keywords: 6-benzyladenine, hyperhydricity, Mediterranean sage, meta-Topolin, zeatin

EFFECT OF EXPLANT TYPE AND BENZYLADENINE CONCENTRATION ON *IN VITRO* MULTIPLICATION OF *SALVIA TOMENTOSA*

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Abstract

Salvia tomentosa Mill. (Lamiaceae) is a Mediterranean perennial sage species, part of the macchia vegetation. Aiming to improve and promote the species for ornamental and medicinal use, in the present work the effect of explant type and benzyladenine (BA) concentration on *in vitro* blastogenesis of the species was studied. Shoot tip or single-node explants from microshoots originated from explants excised from *in vitro* grown seedlings were used. The explants were cultured on MS medium either without plant growth regulators (control) or enriched with 0.4 or 0.8 or 1.6 or 3.2 mg L⁻¹ BA in combination with 0.01 mg L⁻¹ naphthalynacetic acid (NAA). Shoot tip explants responded at higher percentage (59-66%) to form shoots compared to nodal ones (27-48%), at BA concentration 0.4-1.6 mg L⁻¹. In the control, both explant types produced shoots at the same higher percentage (67-69%), whereas at 3.2 mg L⁻¹ BA the lowest percentage of shoot production was observed (16-21%). The percentage of explants that produced hyperhydrated shoots was 13-33%, depending on the treatment. More shoots (1.6-1.7) were produced at 1.6 mg L⁻¹ BA from shoot tip explants and at 0.0-0.8 mg L⁻¹ BA from nodal explants, whereas the number of hyperhydrated shoots was highest (2.1-2.9) at 1.6 (only for nodal explants) or 3.2 mg L⁻¹ BA. The highest multiplication rate and the longest shoots (5.1-5.8 cm) with the highest node number (4.8-5.0) were observed in the control for both explant types, followed by the response at 0.4 mg L⁻¹ BA. In conclusion, the increase of BA concentration resulted in an increase in the number of produced shoots, but hyperhydricity was increased simultaneously.

Keywords: *benzyladenine (BA), hyperhydricity, Mediterranean sage, micropropagation, native plant*

THE EFFECT OF FERTILIZATION REGIMES ON GROWTH AND CHEMICAL COMPOSITION OF *CICHORIUM SPINOSUM* PLANTS

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Abstract

In the current study, it was evaluated the effect of different fertilization regimes on growth and chemical composition of *Cichorium spinosum* plants. The experiment took place at the experimental field of University of Thessaly. Young seedlings after emergence were transplanted in 2 L plastic pots containing peat and perlite (1:1, v/v). Seven treatments were used which varied in the 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 ratio of N:P:K, and the control treatment where no fertilizers were added. Each treatment included fifteen pots (n=15) and all the treatments received the same amount of nutrient solution (150 mL) per plastic plot. Harvest took place on 26th of April 2021 where several morphological traits were measured. Regarding the chemical analysis, it was evaluated the nutritional value of leaves and their content of sugars, organic acids and fatty acids. Based on the results, the treatments of 100:100:100, 300:200:200 and 300:300:300 recorded the largest number of leaves, while no significant differences were observed between the treatments in terms of the fresh weight of leaves. Regarding the chemical composition, there were identified three sugars, namely glucose, sucrose and fructose, whereas polyunsaturated fatty acids were the main category of fatty acids due to the high concentration of α -linolenic acid. Quinic acid was the major organic acid (highest concentrations observed at 300:100:100 treatment), followed by oxalic and malic acid. In conclusion, the growth and chemical composition of *Cichorium spinosum* can be significantly affected by the fertilization regime, while the application of tailor-made nutrient solution could result in improved yield and quality.

Keywords: *Wild edible plants, Cichorium spinosum, nutrient solution, chemical composition.*

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THE EFFECTS OF BIOSTIMULANTS ON MINT CULTIVATION UNDER DEFICIT IRRIGATION

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Abstract

Menthol mint (*Mentha arvensis* L.) belongs to the *Lamiaceae* family and is commercially cultivated worldwide for its essential oils. The present study evaluated the effect of four different biostimulant products (Tr1: vegetable proteins + amino acids + 5% carboxylic acids; Tr2: vegetable proteins + amino acids + seaweed extracts; Tr3: Humic & Fulvic Acids Balanced Solution + seaweed extracts; Tr4: 35% CaO and 35% SiO₂ + Calcium Mobilization and Translocation Factor + 1% Mo, 15% Bo and 30% Zn; and Tr5: control – no biostimulants added) on field grown mint plants (*Mentha arvensis* L.) under deficit irrigation supply (I: 33% of field capacity). Mint crop was established on May 2021, at the experimental field of the University of Thessaly in Velestino, Greece. Harvest took place on September 19, 2021. The aerial parts of fifteen plants from each plot were collected and weighed for fresh yield estimation, while a subsample of 5 plants was air dried at 42°C for further essential oil analysis. After drying, three batch samples were used to measure the essential oil content with a Clevenger apparatus. Our results showed that treatments Tr2 and Tr3 recorded statistically significant higher fresh weight (producing about 1.3 t ha⁻¹) and essential oil yield (10.8 kg ha⁻¹) compared to the rest of the biostimulant treatments, as well as to the control treatment (fresh biomass and oil yield; 0.8 t ha⁻¹ and 4.7 kg ha⁻¹, respectively). In conclusion, it is clearly shown that the tested biostimulants can alleviate the negative effects of deficit irrigation by increasing fresh biomass yield while at the same time increasing oil yield of mint.

Keywords: *Mentha arvensis* L., seaweed extracts, humic and fulvic acids, 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).

THE EFFECTS OF BIOSTIMULANTS ON MINT CULTIVATION UNDER DEFICIT IRRIGATION

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Abstract

Menthol mint (*Mentha arvensis* L.) belongs to the *Lamiaceae* family and is commercially cultivated worldwide for its essential oils. The present study evaluated the effect of four different biostimulant products (Tr1: vegetable proteins + amino acids + 5% carboxylic acids; Tr2: vegetable proteins + amino acids + seaweed extracts; Tr3: Humic & Fulvic Acids Balanced Solution + seaweed extracts; Tr4: 35% CaO and 35% SiO₂ + Calcium Mobilization and Translocation Factor + 1% Mo, 15% Bo and 30% Zn; and Tr5: control – no biostimulants added) on field grown mint plants (*Mentha arvensis* L.) under deficit irrigation supply (I: 33% of field capacity). Mint crop was established on May 2021, at the experimental field of the University of Thessaly in Velestino, Greece. Harvest took place on September 19, 2021. The aerial parts of fifteen plants from each plot were collected and weighed for fresh yield estimation, while a subsample of 5 plants was air dried at 42°C for further essential oil analysis. After drying, three batch samples were used to measure the essential oil content with a Clevenger apparatus. Our results showed that treatments Tr2 and Tr3 recorded statistically significant higher fresh weight (producing about 13 t ha⁻¹) and essential oil yield (108 kg ha⁻¹) compared to the rest of the biostimulant treatments, as well as to the control treatment (fresh biomass and oil yield; 8.1 t ha⁻¹ and 47 kg ha⁻¹, respectively). In conclusion, it is clearly shown that the tested biostimulants can alleviate the negative effects of deficit irrigation by increasing fresh biomass yield while at the same time increasing oil yield of mint.

Keywords: *Mentha arvensis* L., seaweed extracts, humic and fulvic acids, 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).

SEED PRIMING ENHANCES SEED GERMINATION AND SEEDLING GROWTH OF FIVE WILD EDIBLE SPECIES

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Abstract

Cultivation of wild species is often faced with low germination and seedling emergence rates as well as poor stand establishment. Therefore, this study aimed at investigating the effect of various priming treatments to promote germination of *Scolymus hispanicus* L., *Sonchus oleraceus* L., *Crithmum maritimum* L., *Cichorium spinosum* L. and *Portulaca oleracea* L. (two populations). Seed priming was achieved by different physical and chemical treatments, namely hydropriming, NaCl (50, 100 mM), gibberellic acid (10, 50, 100 μ M) and ascorbic acid (50, 100 mg L⁻¹), while non-treated plants served as controls. Priming effects were assessed on germination percentage, seed water absorbance, shoot and root length and seedling vigor index. Seed priming drastically affected all traits in a species and genotype depended manner, as pronouncedly evidenced in *S. hispanicus* which showed the highest germination and growth rates. *S. oleraceus* was benefitted from osmo-priming, especially at 50 mM NaCl, both in terms of germination and seedling growth, whereas *C. maritimum* and *C. spinosum* showed enhanced germination and growth rate at 50 μ M and 10 μ M GA₃. The latter species, also showed enhanced germination capacity at 100 mg L⁻¹ ascorbic acid. In contrast, the germination potential of *P. oleracea* was not positively affected by chemical seed priming, as populations 1 and 2 showed enhanced germination rate either at controls or hydro-primed seeds respectively. Collectively, our findings suggest the potential stimulatory effect of priming treatments on germination of wild edible species, thus providing better prospects for their cost-effective commercial use as alternative/complementary cultivated crops.

Key words: *seed priming, wild edible species, osmo-priming, germination percentage, seedling vigor index.*

Acknowledgments: This work was funded by the General Secretariat for Research and Technology of Greece and PRIMA foundation under the project Valuefarm (Prima2019-11).

EFFECT OF SALINITY ON GERMINATION AND SEEDLING GROWTH OF PUMPKIN GERMPLASM

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Abstract

Salinity is undoubtedly one of the most severe environmental factors, leading to considerable yield and economic penalties to a wide range of cultivated crop species. Given that pumpkin is relatively sensitive to increased salinity, this study aimed at determining the seed germination and seedling growth potential of selected pumpkin germplasm under salt stress conditions as a means to identify salt tolerant cultivars at early growth stages. The genetic material consisted of one commercial variety (Fytro FS 243) and six local landraces, whereas salt stress was imposed by different concentrations of NaCl (0, 100, 200 and 300 mM). Stress tolerance was evaluated on the basis of germination percentage, seed water absorbance (WU %), root and shoot length, seedling vigor index (SVI) and the number of seedlings with abnormal phenotype. Differences between means were compared by the LSD test ($p \leq 0.05$). Salinity stress affected all traits related to germination and seedling growth, with its effects being analogous to the stress level applied. Nevertheless, the genotypes responded differently to the varying stress levels. As such, Fytro FS 243 and landrace 4 proved as most tolerant genotypes. On the other hand, landraces 2 and 3 were incapable of germination at all stress levels, thus indicating their sensitivity even at mild salinity. Given the relatively small range of germplasm under study, overall findings point to the existence of considerable genetic variation related to salt tolerance at germination stage. Upon validation of their reliability, such evaluation criteria may serve for screening salt tolerant pumpkin genotypes to meet current and future challenges.

Keywords: *pumpkin, salinity stress, NaCl, germination stage, early 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).

MORPHOLOGICAL DESCRIPTION OF *CROCUS SATIVUS* IN THE AREA OF KOZANI, GREECE

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Abstract

The aim of the present research was the investigation of the domestic genetic material of cultivated crocus and the evaluation of variability in terms of morphological characteristics. The experiment was established in three different areas of Kozani (Krokos, Protochori, Ano Komi) in order to evaluate the effect of the microclimate on the crocus plant. For this purpose, 250 plants from each area were identified and studied throughout their growing period, and the number of leaves, the length of the leaf, the number of flowers per corm, the number of petals, the length of petals, the number of stigma, the length and thickness of stigma, the number of stamens and the length of stamens were measured. At the same time, the variability of the plants in terms of their morphological characteristics was recorded. From the experiment it was observed that the *Crocus sativus* L. shows a special sensitivity to the microclimate of the area where it grows. It is remarkable that differences in the crocus phenotype were observed not only in the three plots with more or less different climate conditions, but also in the same plot from each region. From the characteristics measured statistically significant differences between the three experimental areas were found only in terms of leaf length and stigma thickness. The significantly longer leaf length was observed in the area of Krokos and the significantly greater thickness of the stigma in the area of Ano Komi. From the above experiment, a large percentage of plants with more stigmas was found in the area of Krokos.

Keywords: *variation, number of stigma, length of stigma, thickness of stigma.*

STABILITY AND HERITABILITY PARAMETERS ON YIELD COMPONENTS OF COMMON VETCH

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Abstract

Common vetch (*Vicia sativa* L.) is a widespread legume crop in the Mediterranean basin and Western Asia. The objectives of plant breeders should be the shift from high-performance varieties towards the varieties achieving nutrient economy and fitting to local environments. The capacity of specific genotypes to adapt in different production systems and locations may ultimately come down to stability performance. Therefore, the primary purpose of this study was to determine yield stability and heritability of common vetch cultivars and yield correlated traits. Six varieties of common vetch (*Vicia sativa* L.), namely, cv. Filippos, cv. Omiros, cv. Alexandros, cv. Tempi, cv. Zefyros and cv. Pigasos, were used. The cultivation was conducted using a strip-plot design with the six varieties randomized within each plot in two farming systems (conventional and low-input). Field experiments were conducted in two consecutive years in four different locations. Mean seed yield reached 20 kg ha⁻¹, with maximum at 30 kg ha⁻¹. Heritability was satisfactory 95.83%. Thousand seed weight (g), weight of pod (g) and pod length (cm) showed the greatest heritability values 99% and above, while number of seed per pod and plant height (cm) showed the lowest, below 50%. Stability index was used to depict which cultivars were more stable across the environments. Both heritability and stability index are considered helpful parameter in breeding.

Key words: *low-input, trait stability index, heritability, common vetch.*

ASSESSING STABILITY AND HERITABILITY PARAMETERS ON YIELD COMPONENTS OF PEAS

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Abstract

Pea (*Pisum sativum* L.) is an herbaceous winter annual and self-pollinated crop. Peas can grow in a wide range of agro-climatic zones, which provides a tremendous scope and potential for cultivation of this crop. The primary purpose of this study was to determine yield stability and heritability behavior of winter pea cultivars and yield correlated traits, as well as to investigate the performance of pea cultivars in conventional and low-input farming systems. Five cultivars of peas, namely, cv. Olympos, cv. Pisso, cv. Livioletta, cv. Vermio and cv. Dodoni, were used. The cultivation was conducted using a strip-plot design with the five varieties randomized within each plot in two farming systems (conventional and low-input). Field experiments were conducted in two consecutive years in four different locations (two locations in Northern Greece and two locations in Central Greece). The plots cultivated under the conventional farming system were fertilized before sowing so that 40 kg ha⁻¹ Nitrogen and 80 kg ha⁻¹ P₂O₅ were added into the soil. For low-input cultivation, no fertilizers or other agrochemicals were applied during the experiment. Mean seed yield reached 280 kg ha⁻¹, with maximum at 406 kg ha⁻¹. Heritability was satisfactory 98.9%. The heritability of all other yield components, i.e thousand seed weight (g), weight of pod (g), pod length (cm), number of seed per pod and plant height (cm) was estimated above 95%. The stability index was used to determine which winter pea cultivars were more stable across different environments. Generally, there were differences in stability across environments and some cultivars showed stability in varying environments. The stability index is a useful criterion in order to recommend a cultivar for a specific environment.

Key words: *low-input; trait stability index; heritability; pea (Pisum sativum L.).*

BIOMASS ANALYSIS OF SANDY GRASSLANDS ALONG THE DANUBE FROM THE PANNONIAN REGION TO THE ROMANIAN PLAIN

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Abstract

Value of meadows and pastures depends on their botanical composition. Incorrect grazing reduces biodiversity in Pannonian grasslands. Hence, it is essential to study the relationship of phytomass and diversity. Based on this, the following research question has been formed: What is the biomass of the dominant *Festuca* species in sand grasslands along the Danube at present? In this study, cut samples were made along the Danube, from Hungary to Serbia, including Bulgaria and Romania, too. Cut biomass was sorted according to the following classifications: 1. *Festuca* taxa, 2. other grasses; 3. legumes; 4. other dicots; 5. other monocots; 6. dead leaves. Based on the results, *F. pseudovaginata*, *F. wagneri* and *F. vaginata* had heavier masses of dead leaves. Prickly plants had the highest occurrence rate in *Festuca wagneri* associations, in contrast, *Festuca vaginata* associations had no prickly plants at all. Thus, closed sandy grasslands and forest edges contain more prickly plants. Other monocots occurred in variable proportions in the studied *Festuca* populations. In the case of *F. rupicola*, *F. javorkae*, the mass of dicots in the biomass of the *Festuca* samples was significantly higher. Biomass of legumes was the highest in populations of *F. wagneri* and *F. javorkae*, *F. rupicola*. Biomass of *Festuca* species was the lowest in *F. vaginata* and the highest in *F. rupicola/javorkae* populations. Therefore, it can provide adequate pasture for sheep, but it should avoid overgrazing. This research was supported by the OTKA K-125423.

Keywords: *biomass, grazing, nature conservation, sandy grasslands*

NUTRITIONAL VALUES ANALYSIS OF SANDY GRASSLANDS ALONG THE DANUBE FROM THE PANNONIAN REGION TO THE ROMANIAN PLAIN

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Abstract

Grazing livestock farming has a long tradition in Hungary. The most valuable feed for grazing animals is provided by plants of grasslands. Supplementation of feed rations with fiber increases the saturation of digestive tract, thus making the animals calmer and improving animal welfare. Grasses can be useful supplements as they contain a lot of digestible fiber. Our aim is to find out about the grassland management values of sandy grasslands dominated by *Festuca* species along the Danube. Cut samples were made along the Danube, beginning in the northwestern part of the Little Hungarian Plain, across the central sandy plains of the Carpathian Basin to the southernmost part of the Basin at Deliblato, Serbia. The last samples were made beyond the Carpathians on the Romanian Great Plain and Bulgaria. Weende analysis of the cut samples was carried out in the laboratory of MATE. Their original dry matter, crude protein, crude fat and crude fiber content were analyzed, and fiber fractions (NDF, ADF, ADL) were measured. Based on the results, contents of absolute dry matter, crude fiber and NDF were high in all samples. The five samples of the analyzed *Festuca* species showed significant differences between dry matter and crude fiber. *Festuca wagneri* had the highest dry matter content. The highest crude protein contents were found in *Festuca vaginata*, *Festuca wagnerii* and *Festuca rupicola* samples, the highest crude fiber content in *Festuca tomanii* samples.

Keywords: *feed value, fescue.*

RECENT ADVANCES IN DIRECT DRILLING TECHNOLOGY FOR SOYBEAN (GLYCINE MAX L.) PRODUCTION

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Abstract

Soybean (*Glycine max* L.) is one of the most important sources of essential protein and due to its capability for nitrogen fixation, also a key part of the crop rotation. However, water is an important limiting factor to growing crops, an increased interest can be seen in soybean global production in recent years. Soil management systems can affect the quality and sustainability of agricultural production since soil tillage modifies surface cover and directly affects the soil structure. However, the shortage of admissible water and higher costs of production due to the increasing costs of energy resources risk the agricultural production which leads to social, economic and environmental difficulties. Direct drilling is widely used as an important agricultural practice since the continuous conservation tillage improves soil properties and modifies impact of weather extremes. Conservation tillage began during the 1960s in the USA and it is expected to be a widespread agricultural practice in the future. The aim of this study was to evaluate the effects of the direct drilling technology on the soybean yield since direct drilling is getting larger year by year. Scientific literature regarding the influence of direct drilling on the soybean yield quality is quite limited, however, direct drilling is an effective strategy for soybean cultivation considering is beneficial to increase the yield and yield stability and has the advantage of high water consumption. To solve the problem of high costs and low production efficiency in soybean production, the preservation of natural resources and environmental stability are crucial.

Keywords: *direct drilling, soybean, Glycine max L., soil tillage, energy saving*

EFFECT OF DIFFERENT NITROGEN SUPPLY ON THE YIELD AND NDVI VALUES OF EXTENSIVE AND INTENSIVE WINTER WHEAT GENOTYPES

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Abstract

Nitrogen supply affects the yield and crop parameters of winter wheat both directly and indirectly. The application of nitrogen significantly affects photosynthetic activity, plant height, biomass weight and yield. In our studies, we examined the nitrogen response of an extensive winter wheat cultivar with high biomass weight and an intensive genotype on humic sandy soil. In our studies, we determined the NDVI values of winter wheat cultivars in five different phenophases, recorded the extent of lodging and measured the yield and volume weight in a favorable year for winter wheat. Regarding NDVI values, a significant nitrogen effect was observed in the case of the extensive genotype, while in the case of the intensive genotype this reaction proved to be much smaller for all studied time. In the case of the extensive genotype, the extent of lodging was already large-scale in the control treatment (85%), even in the case of the intensive variety no statistically significant lodging rate was observed. Regarding the yield, the nitrogen reaction was negative in the case of the extensive genotype, the highest yield was achieved in the control treatment (5116 kg ha^{-1}). A minimal nitrogen reaction was observed in case of intensive genotype. In the case of volume weight, the application of nitrogen did not significantly affect its value, we showed a genotypic effect in terms of this parameter. Based on the results of the correlation studies, it can be stated that in the case of extensive genotypes, no positive correlation can be detected between the yield and the NDVI values. The extent of lodging in case of extensive genotypes is decisive for grain yield.

Keywords: *winter wheat, nitrogen, lodging, yield, NDVI value*

OIL RADISH (*RAPHANUS SATIVUS* VAR. *OLEIFORMIS*) AS A PROMISING GREEN MANURE CROP IN CROP ROTATION SYSTEMS

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Abstract

Catch crops or green manure plants play an important role in sustainable agricultural systems, as they have a positive effect on the soil fertility, elimination of erosion, limiting the loss of nutrients thereby catch crops acts as a fertilizer, they can increase the yield of the main crop. Cruciferous catch crop plants, such as oil radish (*Raphanus sativus* var. *oleiformis*) have deep root systems and produce large amounts of above-ground biomass during the fallow period in case of adequate rainfall. In our study, our goal was to determine the value of oil radish as a catch crop, considering its effect on the yield of next crops. We examined three different oil radish seed rate in a crop rotation with triticale, oat and corn. We evaluated the aboveground biomass weight of oil radish and its relationship with the NDVI values and yield parameters of the subsequent crops. Next to the catch crop treatments, we used fertilized (80 kg N ha⁻¹) and fallow control treatment for comparison. We achieved above-ground biomass yield between 22.76 and 33.78 t ha⁻¹, with no significant differences between the different seed doses. Based on the NDVI measurements in triticale and oat, we found that the effect of the catch crop treatments significantly exceeded the results of the control-treated plots. In case of seed yields, 48% higher triticale yield, 61% higher oat yield and 27% higher corn yield were measured compared to the control plots, and effect of catch cropping was found to be equivalent to the effect of mineral fertilization for all three plants.

Keywords: *oil radish, catch crop, green manure, crop rotation, yield*

THE EFFICACY OF INSECTICIDES IN CONTROLLING OF TASAR PLANT STEM BORING BEETLE, *PSILOPTERA FASTUOSA* (COLEOPTERA: BUPRESTIDAE)

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Abstract

In tropical tasar silk culture Arjuna plants (*Terminalia arjuna*) (Combretaceae) are widely cultivated in outdoor farms because the tasar silkworm, *Antheraea paphia* (Lepidoptera: Saturniidae) feeds primarily on Arjuna leaves. However, the flat-headed stem-boring larvae of *Psiloptera fastuosa* (Coleoptera: Buprestidae) severely damage the young Arjuna stems by making extensive galleries following wilting. Since the buprestid grubs develop and grow primarily within the Arjuna stems, they are difficult to control and therefore, adult buprestids could be managed as an alternative. The present study demonstrates the effect of few chemical and botanical pesticides on adult *P. fastuosa* survival. A dose of 0.05% phosphamidon or cypermethrin was found effective in treating *P. fastuosa* adults; when the pesticides were exposed to at 1–8 µg/individual, they died. Up to three days from adult emergence from pupa, none of the newly emerged adults died even though insecticides were applied. However, advanced adults over three days died because the pesticides primarily act on their chitin. When phosphamidon and cypermethrin were applied over 8 µg/individual, it turned significantly lethal, resulting 92.45% adult mortality. However, in such cases, fledgling adults less than three days old starved to death. When exposed to higher doses, advanced adults experienced incomplete-development (wings and appendages) and eventually died. The result demonstrates that different insecticidal doses resulted in different mortality rates of buprestid adults of varying ages. Plant extracts from Neem (*Azadirachta indica*, Meliaceae), Pongamia (*Pongamia glabra*, Fabaceae), and Ocimum (*Ocimum sanctum*, Lamiaceae) when applied to adults, variable mortality responses were observed. Maximum mortality (50-70%) was recorded for neem treatment (LC50: 6.50), followed by Pongamia (48–60%; LC50: 6) and Ocimum (43–61%; LC50: 5) than control (5-15%). Since direct correlations between pesticidal dose and beetle-mortality were observed, their mortality can be designated as dose-dependent. At higher doses of pesticides several morphological abnormalities in wing and appendage development were observed.

Keywords: *Tasar culture, Psiloptera fastuosa, pesticides, control.*

EVALUATION OF GENETIC DIVERSITY OF DIFFERENT POTATO GENOTYPES USING OPB MOLECULAR MARKER

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Abstract

In this research, OPB molecular markers was used to study the genetic diversity of 45 potato genotypes. Five primers were used to amplify the genomic DNA fragments of potato genotypes. Optimal genetic diversity based on OPB marker was observed among genotypes. OPB primers amplified 57 scoreable DNA fragments and totally 758 DNA bands. All amplified bands were polymorphic. The number of amplified fragments varied with different primers. The band sizes produced in primers ranged from 250-2000 pairs. The number of bands in each primer ranged from 9 to 14 bands. The highest number of production bands was 14 by OPB-4 primers. The mean polymorphic content (PIC) and mean marker index (MI) were 0.82 and 9.42, respectively. OPB-1 primer had the highest Marker Index (MI) and Effective Multiplex Ratio (EMR), and primer resolution (RP). The results obtained from the similarity matrix showed that the genetic distance between the studied populations and species varied in the range of 0.05 to 1. According to the results obtained from Jakard coefficient, the highest genetic similarity (1) was between Ver/75 and Ver/71. After that, dms/21 and dms/4; pnt/40 and pnt/42 had high genetic similarity (0.947 and 0.867, respectively). The lowest genetic similarity (0.050) was between brd/77 and Fen/37. The studied genotypes were grouped into seven main groups using UPGAM cluster analysis and Jaccard similarity coefficient. The OPB marker distinguished some Mexican diploid accessions with genome B from other accessions with genomes A and B. The results showed that the OPB marker is a reliable marker for detecting high levels of polymorphism and can be used to study genetic diversity and in potato breeding programs.

Keywords: *Cultivated potatoes, Marker index, Genetic diversity, RAPD markers, PIC.*

INVESTIGATION OF GENETIC RELATIONSHIPS OF SOME POTATO GENOTYPES, USING SINE MARKERS

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Abstract

SINE markers are very useful for studying the phylogeny and genetic diversity of eukaryotic organisms such as plants. In this study, the diversity and genetic relationships of 45 potato genotypes were evaluated using SINE molecular markers. A total of 57 scoreable amplified DNA fragments with 798 amplified bands in the size of 110 to 1200 bp were observed using 5 primers, showing all polymorphic fragments. The highest content of polymorphic information (PIC), Marker Index (MI), Effective Multiplex Ratio (EMR), and primer resolution (RP) was related to SINE 1 (IIIaF/IVR). The results obtained from the similarity matrix showed that Dms/21 and dms/4 species had the highest similarity. The important point obtained from this similarity matrix was that Ver/71 and Ver/75 species also had a high amount of similarity (0.955) and were close to the maximum similarity. Cluster analysis of genotypes performed using Jaccard similarity coefficient by UPGMA method. According to the results of dendrogram, the studied samples divided into 5 groups with SINE marker. The SINE markers differentiated the accessions possessing A and B genomes and grouped wild Mexican diploids possessing B genome (6 specimens), and accession (with 2x, 4x, and 6x ploidy levels) and commercial cultivars possessing A genome (38 specimens) separately. Tomatoes, eggplants and *Solanum brevidense* were divided into separate groups. In general, according to all indicators, SINE primers are introduced as the best primers to study the genetic diversity of potatoes.

Keywords: Domestication, Germplasm, Retrotransposons, *Solanum*, Tuber-bearing species.

HOW LED LIGHTS AFFECT CHLOROPHYLL FLUORESCENCE AND CHANGE THE CONTENT OF PHOTOSYNTHETIC PIGMENTS IN *HYOSCYAMUS NIGER* L

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Abstract

The light quality plays an important role in all steps of growth process particularly in photosynthesis properties of plant species. LEDs present the maximum efficiency among artificial lighting systems. Research experiments were conducted on *Hyoscyamus niger* L in a completely randomized design with three treatments of different LED light color (Blue, Red and White) and glycine (0, 40 and 80 mg.l⁻¹) and 3 replications. Seedling establishment, light treatments were applied. After two weeks, foliar spraying were treated in three stages every 10 days. Two weeks after the last glycine foliar application, Chlorophyll fluorescence and leaf color changes were examined. The results showed that The highest Fv/Fm (0.839) obtained in R LED light under glycine treatment at 80 mg. l⁻¹ and the lowest (0.659) values were detected in W LED grown plants. The highest Fv/Fo (5.231) value was from plants grown under R LED lighting with glycine treatment at 80 mg.l⁻¹; however, C (normal light conditions) treatment had the lowest value among the treatments. Compared with chlorophylls contents under B LED light with glycine, the carotenoid contents under W LED light were dominant either in *H.niger*.

Keywords: *Carotenoid, Chlorophylls, LED, Chlorophyll fluorescence*

LED LIGHTS CAN INCREASE YIELD AND PHYSICOCHEMICAL PROPERTIES OF SUNFLOWER MICROGREENS

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Abstract

Microgreens have appeared on the market and are more popular than mature leaves due to the high density of nutrients in the pair. The present study was performed in experiment to evaluate the effects of substrate type on morphological and physiological indices of sunflower microgreens under the influence of factorial experimental light quality in a completely randomized design with three replications in controlled laboratory conditions. The first factor included the culture medium (soil and coco peat) and the second factor included the light spectrum at four levels (including blue, red, white and sunlight (control)). The germination to harvest time for sunflower microgreens was 7-21 days. At the end of the treatment period, traits such as yield, plant height, hypocotyl length, leaf area, phenols and flavonoids were measured in sunflower microgreens. The results showed that the effect of culture medium and light treatments on growth and physiological characteristics in sunflower microgreens was significant. The highest plant height, phenols and flavonoids were obtained in plants grown in soil substrate and under blue light conditions.

Keywords: *LED light, plant height, leaf area, microgreens*

DIFFERENT HOSTS CAN EFFECT ON ANTIOXIDANT PROPERTIES OF MISTLETOE

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Abstract

Mistletoe plant (*Viscum album*) is a species of the family *Santalaceae*, commonly known as European mistletoe, common mistletoe, or simply as mistletoe. It is native to Europe and western and southern Asia. Mistletoe is a hemiparasite on several species of trees, from which it draws water and nutrients. Mistletoe plant samples were harvested in the summer of 2021 from three hosts; apple, apricot, and plum in two stages (before and after fruit ripening) in three replications. The samples were moved to the laboratory and the levels of total antioxidants, phenol, flavonoids, and total protein in fruits, leaves, and stems were examined. The results showed that the highest amount of total antioxidants (27.066 %) were obtained after fruit ripening in fruits. The amount of total phenol was increased during different stages of harvest so that the highest amount of phenol (14.73 mg.g⁻¹) was observed during after fruit ripening. Our results showed that the amount of protein in fruits at post-fruit ripening stage was observed in the apricot host.

Key words: *Hemiparasite, Mistletoe, phenol, protein, Santalaceae*

CORRELATION ANALYSIS OF SOME MORPHOLOGICAL TRAITS IN THE COMMON SAINFOIN

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Abstract

Sainfoin (*Onobrychis viciifolia* Scop.), as a tetraploid ($2n = 4x = 28$) perennial forage legume, which belongs to the *Fabaceae* family, is rich in proteins and some secondary plant metabolites. A field experiment including 32 common sainfoin genotypes was set up with the aim of determining some morphological traits. The following traits were measured: number of stems per plant (NSP), number of nodes per main stem (NMS), height of longest stem (HLS), peduncle length (PL), length of inflorescence (LI), number of internodes per main stem (IMS), internode length (IL), number of leaves per main stem (LMS), number of leaves per stem (LS), and number of leaflets per leaf (NLL), dry weight total (DWT), number of plants per area (NPA) and stem weight / leaf weight ratio (SLR) traits. Positive and statistically significant correlations were determined between DWT and all of the measured traits except for IL. The length of inflorescence was significantly positively correlated with number of leaves per stem (LS) and number of leaflets per leaf (NLL), IL and LMS. Also, we found significant positive correlation between IL and LMS, as well as between LMS with LS and NLL. The positive significant correlations were observed between LS with SLR and NLL as well as between SLR and NLL. The importance of main stem properties like length or height, number of leaves, and number of leaflets can be seen for selection, in genetic improvement programs.

Keywords: *dry forage yield, main stem properties, Onobrychis viciifolia* Scop.

P1 GENE IN MAIZE REDUCES FUSARIUM EAR ROT SYMPTOMS AND ACCUMULATION OF THE FUMONISINS

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Abstract

One of the purposes of maize genetic improvement is the research of genotypes resistant to fusarium ear rot (FER) and fumonisins accumulation. Flavonoids accumulated in the maize pericarp layer are associated with a reduced level of fumonisins contamination. In particular phlobaphenes are insoluble phenolic compounds conferring a typical red-brown seeds pigmentation. These secondary metabolites, derived from 3-deoxy flavonoids, are thought to have an important role in plants' resistance against various pathogens, e.g., by reducing fungal infection, and also to have beneficial effects on human and animal health due to their high antioxidant power. The aim of this work was to assess the effect of flavonoids, associated with anti-insect protection and *Fusarium verticillioides* infection, on FER symptoms and fumonisins contamination in maize kernels. We used two biallelic synthetic populations (*PI* vs *pl* in two different genetic background). We analysed the effect of the *PI* (*pericarp color 1*) gene on phlobaphenes accumulation and fumonisins accumulation. The coloured lines, carrying *PI* allele, showed an increase of phlobaphenes (about 10–14 fold) with respect to colourless lines and a clear decrease of fumonisins accumulation. These results suggest that the *PI* gene plays a central role in regulating phlobaphenes accumulation in maize kernels, and indirectly, also tackles mycotoxins accumulation. The development and cultivation of corn varieties rich in phlobaphenes could be a powerful tool to reduce the loss of both quality and yield due to mycotoxin contamination, increasing the safety and the quality of the maize product.

Keywords: *Zea mays*, *fusarium ear rot*, *phlobaphenes*, *fumonisin*.

NEW HOLISTIC DATABASE CONCEPT FOR AGRO-BIODIVERSITY KNOWLEDGE, CONSERVATION AND PROTECTION

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Abstract

Landraces are an agri-food and historical-cultural heritage, but there is a continuing loss of them worldwide affecting the ecology of the agrarian landscape and the local social-economic dynamics. Worldwide initiatives have been undertaken to conserve and protect local plant genetic resources, based on specific guidelines. Currently, the approach to databases for biodiversity conservation is often focused on one or few aspects of landraces characterization and conservation. Efforts in the conservation of agro-biodiversity cannot be separated from an awareness of the magnitude of it in specific area, and cognitive surveys are needed leading to an enormous amount of data that needs organization and scientific objectivity. In this light, here we present a new holistic database concept for the conservation and the protection of agro-biodiversity, within which definition of a dense network of in-situ and ex-situ conservation is based on a rigid scientific investigation aimed at the location, identification and characterization of fruit trees landraces. Characterization of the landraces, for proper identification, was performed on a genetic, morphological, biochemical and agronomic basis, allowing data to be stored within a structured dataset. For identified landraces, pertaining to 13 tree species, areas of origin, cultivation and conservation, custodian farmers and germplasm banks were identified when defining the conservation network. All spatial information was georeferenced in a GIS environment to allow overlays characterizing environmental features. Databases structured in this way can enable the expansion of the landraces conservation network to various scales, up to the global scale, through communication and data exchange among different experiences.

Keywords: *Agro-biodiversity; Database; Plant Genetic Resources; Landraces; Conservation Biology*

AGRO-DIVERSITY: THE BEAUTIFUL AND THE USEFUL. THE CASE STUDY OF FALANGHINA (*VITIS VINIFERA*) OF SANNIO (SOUTHERN ITALY)

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Abstract

For the first time we present the concept and preliminary results of a research project (funded by Italian National Operational Program) aimed at define the Falanghina (*Vitis vinifera*) holistic *terroir* as characterizing factor but also to discover possible adaptive strategies of the agroecosystem under environmental and climate changes. The study area is a wine-growing district of Sannio (Southern Italy). The viticulture system was explored from landscape to molecular scale. At the landscape scale, the environmental ecomosaic and the ecological connectivity of the area were assessed. For *terroir* definition, at the vineyard scale, we reconstructed pedogenic profiles and analyzed the chemism and microbiome of the Falanghina system. In addition, microbiota analysis and PGPR selection were conducted to formulate a microbial consortium as a strategy to improve plant responses to both abiotic and biotic stresses. Our results showed that the agricultural landscape plays an important role in maintaining a complex environmental ecomosaic, elevating the value of connectivity for the continuity of areas of high ecological value. Preliminary results show differences among the vineyards analyzed, reflecting chemical and microbiological variability of soil types. With this research, we seek to obtain data-drive management decisions on the appropriate practices and microbial inoculants to optimize the health of soil and crop for their specific region. It could be a useful blueprint in viticulture to find site-specific solutions to the challenges to which this production of incalculable cultural and economic value is currently subjected or by which it may be affected in the future.

Keywords: *vineyard resilience, holistic terroir, Vitis vinifera, plant protection, plant-environment fingerprint.*

GENETIC PROFILE INVESTIGATION OF MEDITERRANEAN OLIVE CULTIVARS BY COMBINED ANALYSIS OF GENOTYPE-SPECIFIC MOLECULAR MARKERS

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Abstract

Olive (*Olea europaea* L.) is one of the most economically relevant crops in the Mediterranean basin. The genetic background of the olive tree is extremely rich, but the spread of intensive agriculture resulted in the use of few productive genotypes and a gradual reduction in genetic diversity. However, the landraces represent an important agri-food and cultural-historical heritage and need to be safeguarded. The protection and enhancement of agrobiodiversity are key aspects to preventing the loss of landraces that are gradually being lost. The long-lived character of the olive tree and prevalent allogamy have resulted in high levels of heterozygosity and the accumulation of numerous mutations. Correct identification of olive cultivars is the first step in their preservation, but distinguishing between different cultivars is extremely complicated due to the high frequency of homonyms and synonyms. This study aims to assess the genetic diversity of the most widespread olive tree accessions in the Campania region (Southern Italy) through the combined analysis of genotype-specific molecular markers as Simple Sequence Repeats (SSR) and Single Nucleotide Polymorphism (SNPs). SSR analysis was performed by fluorescence capillary electrophoresis. SNPs were identified by Sequence Based Genotyping technology (SBG) and were useful for predicting the effects of the identified variants on genes and the level of genetic diversity. In addition to the genetic identification of various cultivars, this research aimed at the establishment of a DNA bank that will be useful for the conservation and valorisation of RGVs, traceability of valuable RGVs, and identification of new genes.

Keywords: *genetic identification, Simple Sequence Repeats (SSR), Single Nucleotide Polymorphism (SNPs), Olea europaea* L., *cultivars*.

CAMELINA SATIVA BREEDING PROGRAM ASSISTED BY GBS ANALYSIS.

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Abstract

Camelina (*Camelina sativa* L. Crantz) is a promising oilseed crop used for different purposes. It is an herbaceous annual plant belonging to the Brassicaceae (Cruciferae) family originated from South Eastern Europe and South Western 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. 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 with high yields and oil content. Breeding program was based on bulk method and supported by molecular markers (SSRs) and GBS (Genotyping by Sequencing) to select the best parentals and to characterize/compare the new varieties obtained. The yield of new genetic materials was compared in winter and spring cultivation. Preliminary data suggest the winter varieties guarantee the best yield performance and oil content. Further work in multi-environments will be necessary to assess the real value of the new varieties obtained compared to commercial benchmark.

Keywords: *Camelina sativa*, GBS, plant breeding, yield, oil content.

FAGIO.LO PROJECT: BEAN LANDRACES STUDY OF LOMBARDY REGION (NORTHERN ITALY)

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Abstract

Biodiversity conservation is one of the most debated issues in recent years from the local to the global level. The loss of biodiversity does not only concern wild species, but also species of agricultural and food interest (agrobiodiversity). This loss affects the food and traditions that identify the territories, in particular in the mountain areas where the added value (economic and historical-cultural wealth) is decreasing more and more. Bean (*Phaseolus* spp.) is one of the most cultivated legumes for direct human consumption, due to the protein content (about 20%), starch with low glycemic index (about 38%), B vitamins, molecules with antioxidant power, minerals and lipids. Beans have been for centuries one of the basic foods of the farming world, including that of Lombardy region (Northern Italy). The consumption decreased with industrial development; the demand has varied due to the change in food styles and the smaller number of farms traditionally dedicated to these productions. Nowadays, there is a renewed interest in legumes particularly in local varieties that attracted the consumers' attention. In this work, 30 bean landraces grown in Lombardy were collected and studied for the conservation and promotion of plant biodiversity, to enhance bean cultivars so far little known, cultivated / preserved by a few farmers and therefore at risk of extinction. This study will contribute to the research, characterization, promotion and conservation of PGRFA (Plant Genetic Resources for Food and Agriculture). These landraces were characterized by SSR to assess genetic structure and to assist in future breeding programs.

Keywords: *PGRFA, agrobiodiversity, landraces, Northern Italy, bean.*

MIND FOODS HUB PROJECT: DEVELOPMENT OF A NEW PUMPKIN VARIETY WITH HIGH CAROTENOID CONTENT

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Abstract

MIND Foods Hub is an innovative concept for the eco-intensification of agricultural production and for the promotion of food models for human health and longevity through the creation in MIND of a digital hub food system. The project is funded by the “Research and Innovation Hub” call of the Lombardy Region. It integrates multidisciplinary skills to promote an international vision of agri-food research as an engine of innovation, development, and social responsibility. One of the main objectives is sustainable production and processing of plant products with an excellent nutritional profile. For this purpose, a breeding program based on “pedigree method” is being developed to achieve new pumpkin varieties with the aims to improve carotenoids content, sensory characteristics and consumer acceptability. Pumpkins (*Cucurbita* L. spp.) are characterized by a large genetic variability. The three most important species are *Cucurbita maxima*, *Cucurbita moschata* and *Cucurbita pepo*. *Cucurbita maxima* is the most popular species both in developed and in the low-income countries where is one of the main sources of minerals and vitamins, in fact, it 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 are rich in carotenoids, especially in β -carotene and in sugars, starch, vitamin C, vitamin E and fiber. In this work, the latest advances in the breeding program will be shown regarding the development of the most promising materials with the related preliminary product analyzes.

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

GENETIC VARIATION AND HERITABILITY FOR JUICE QUALITY AND YIELD TRAITS IN SELECTION OF SUGARCANE GENOTYPES UNDER IRRIGATION AT EARLY STAGE IN FERKÉ 2 SUGAR ESTATE OF NORTHERN IVORY COAST

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Abstract

Genetic relationships between important attributes in studying sugarcane populations through breeding and direct selection, are crucial to understand how changes made by selecting one character may cause changes in others. The study aimed to determine the best yielding sugarcane genotypes tested at early selection stage under sprinkler irrigation, in comparison with a check variety (R579). The experiment was designed following a randomized complete block (RCB), with 30 cane genotypes in three replications. Each plot consisted of five dual rows of ten meters, with 0.5 and 1.90 m of inter-row spacing, i.e. 95 m² per plot and nearly 6,000 m² for the whole experiment. In each micro-plot, different agro-morphological traits were collected at harvest from three central dual rows. The study showed that most relevant traits in genotype clustering were related to juice quality (recoverable sucrose, sucrose content, purity), yields and some yield components like single stalk height, and single stalk weight. Based on sugar yields, three genotypes over-classing the check variety (R579), namely RCI14/128, RCI11/112, and RCI11/190, were determined for the late selection stage, with 16.4, 15.8 and 15.0 t sugar/ha, respectively. Their cane yields reached 151.5, 164.2 and 132.6 t/ha, respectively, compared to 146.1 t/ha for the check, and belong to two clusters genotypes over six determined. Except for juice purity and cane fiber content, all agro-morphological traits investigated could explain the genetic variation of sugarcane genotypes tested, with stem borer infestation rate, cane and sugar yields, and number of tillers/ha as the most relevant traits in this regard.

Key words: *phenotype, genotype, environmental influence, multivariate analysis, genetic advance.*

DEVELOPMENT OF SSR MARKERS LINKED TO STRESS RESPONSIVE GENES ALONG TOMATO CHROMOSOMES (*SOLANUM LYCOPERSICUM* L.)

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Abstract

This study was aimed to develop novel SSR markers in tomato. Several BAC clones along chromosome 3 in tomato were selected based on their content. The criteria was the availability of stress related loci, either directly or indirectly related to stress response (drought, salinity, heat) in tomato. Twenty novel SSR marker in silico were developed and 96 important nearby genes were identified. The identified nearby genes representing different tomato genes involved in plant growth and development, and biotic and abiotic stress tolerance. The developed SSR markers were assessed using tomato landraces. A total of 29 determinate and semi-determinate Jordanian tomato landraces collected from diverse environments were utilized. A total of 33 alleles with mean of 1.65 alleles per locus were scored and showed 100% polymorphic patterns with mean of 0.18 polymorphism information content (PIC) values. Mean of observed and expected heterozygosity were 0.19 and 0.24 respectively. The mean value of Jaccard similarity index was used for clustering the landraces. The developed microsatellite markers showed power to assess genetic variability among tomato landraces. The genetic distance information reported in this study can be used by breeders in genetic improvement of tomato landrace for tolerance against diverse stresses.

Keywords: *BACs, Heterozygosity, polymorphic information content, SSRs*

THE EFFECTS OF AN INNOVATIVE DIGESTATE AND WOOD ASH MIXTURE FERTILIZER ON POTATO YIELD QUALITY

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Abstract

Field trials with the potato variety 'Rigonda' were carried out in a sod stagnogley soil. Soil agrochemical parameters were: pH_{KCl} 5.9, organic matter content – 2.3%, phosphorus (P_2O_5) content – 149 mg kg^{-1} , and potassium (K_2O) content – 200 mg kg^{-1} . Potato plots were established using different treatments of a fertilizer mixture consisting of pig and cattle manure digestate and woodchip ash in different ratios (digestate to wood ash = 4:1 and 3:1). The doses of the innovative mixed fertilizer for potato were 15 and 30 t ha^{-1} . Both norms of the digestate from pure pig and cattle manure were used as control options. The experimental design was an RCB with three replications. Crude protein content in potato dry matter varied from 8.28% to 10.94%. The application of fertilizer mixtures increased the dry matter content by 1.4–2.0%, reaching an average of 21%. Fertilizer treatments which produced higher tuber yields or higher starch contents gave also higher starch yields. In our studies, the average starch content in potato tubers dry matter was 73.3% and 15.3% in a fresh potato tuber, but the average starch yield reached 3.55 t ha^{-1} . The objective of the research was to study the influence of the rates of the digestate and wood ash mixture fertilizer on the quality of potato yield.

Keywords: *digestate, wood ash, fertilizer, potato, yield quality.*

INFLUENCE OF BIOGAS DIGESTATE, WOOD ASH AND THEIR MIXTURES ON THE YIELD AND QUALITY OF CUCUMBERS

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Abstract

The biogas digestate can be an alternative of synthetic fertilizers in agricultural practice. Without additives, the drying of digestate can be unprofitable. The addition of wood ash to digestate dehydration process gives the opportunity for soil liming as well as for soil enrichment with nutrients. Within the framework of a Latvian National Research project, it was necessary to compare digestates from various raw materials and to test the possibility of mixing them with ash for using in cultivation of fast-growing crops. The research aimed to evaluate the influence of biogas digestate and wood ash on the yield and quality of cucumbers in a polycarbonate greenhouse. The experiment was performed in 2020, using 11 fertilization treatments as well as peat ($\text{pH}_{\text{KCl}} 5.5$) as the control. In the start of the experiment, no significant differences in the acidity of substrates was observed, but at the end of the investigation, pH_{KCl} varied from 6.8 till 7.5, that was non-optimal for cucumbers growing. The development of plants under the different treatments was not significantly different ($p > 0.05$). During the experiment, cucumbers were harvested 23 times. The count of fruits per plant, depending on the treatment, per each harvesting varied from 1 till 9 (maximum result was observed for the digestate from pig manure and horse manure). A significant effect of fertilization treatment to cucumbers yield was observed ($p < 0.05$). The organoleptic parameters were not differed significantly throughout the growing season ($p > 0.05$).

Keywords: *biofertilizers, fertilization treatment, digestate, wood ash, fast-growing vegetables.*

EFFECTS OF FOLIAR APPLICATION OF ZINC NANOPARTICLES IN LETTUCE (*LACTUCA SATIVA* L.) PLANTS

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Abstract

The trace element Cu plays an important role in both plant development and human health. To solve this problem, it was chosen to use different sizes of metal-based CuO nanoparticles. The effect of CuO nanoparticles depends on the plant species and the concentration of the nanoparticle solution, but there is still a lack of information on the effects of nanoparticle sizes on plants. The effect was studied by spraying lettuce (*Lactuca sativa* L. cv. Little Gem) with 10, 20, and 80 nm nanoparticles of the 20 mg/l concentration. Plants were grown hydroponically (pH – 5,5 and the electrical conductivity – 1,36 mS/cm) in controlled environment chambers (PFD – 220 $\mu\text{mol m}^{-2} \text{s}^{-1}$, 18 h photoperiod, $21/17 \pm 2$ °C temperature, 60% \pm 5% relative humidity). The antioxidant capacity of lettuce leaves was evaluated by ABTS, DPPH, FRAP, and TPC analysis. The quantification of the elements was also performed. All biochemical analysis was performed in 3 biological and 3 analytical replications. Based on the results, the strongest antioxidant capacity response was in lettuce sprayed with CuO 40 nm nanoparticles, and the lowest activity was found in lettuce sprayed with CuO 10 nm nanoparticles suspensions. In the leaves, the Cu content was increased by all CuO nanoparticle suspensions, regardless of the size of the nanoparticles. CuO nanoparticles increased the amount of Cu in the roots from 10 to 20%.

Keywords: *CuO; Lactuca sativa L.; antioxidants; mineral elements*

Acknowledgments: This project has received funding from the Research Council of Lithuania (LMTLT), agreement No. S-MIP-21-27.

DETERMINATION OF IRREGULARITIES IN POLLEN GERMINATION AS INDICATORS OF YIELD AND QUALITY OF SOME BALKAN GRAPEVINE VARIETIES

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Abstract

In our studies in this paper are described some properties and possible anomalies in meiosis cell divisions in the formation of female and male gametes in the production of pollen cells and embryogenesis in flowers in some table varieties of grapevine. Cell divisions are factors that are directly responsible for the proper function of pollen grains and the ability for autogamy and xenogamy fertilization in grapevine. They also indirectly affect the quality (beautiful appearance and compactness of the bunch) and the yield of the grapevine (number of fertilized grains in the bunches). The tests were performed on the varieties White Winter, Red and Black Valandovo Drenok, Red Globe, Vranec, Victoria, Palieri, Temjanika and others. The varieties are taken from different plantations of the Skopje, Tikvesh and Gevgelija-Valandovo vineyards in the period 2016-2019. During the examination, the flowers were first analyzed before the opening of the flower caps. Preparations were made with special methods and dyeing and meiosis divisions, germination and pollen functionality were observed. Self-fertilization (autogamy) and foreign-fertilization (xenogamy) were examined by isolation of inflorescences. Finally, fertilized and unfertilized grains are counted and organoleptic assessments are given. Those varieties that have proper divisions and hermaphroditic flowers (self-fertilization) have been shown to have good pollen germination, well-fertilized clusters and quality yields (such as White Winter, Vranec, etc.). It can be concluded that the aforementioned varieties, in the selection and refining of the varieties, can be used as good pollinators individually or in a mixture of pollen to improve the characteristics of the varieties.

Keywords: *cell division, germination, pollen, autogamy, xenogamy, yield*

MORPHOLOGICAL TRAITS OF SOME VIRGINIA TOBACCO VARIETIES AND LINES

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Abstract

Investigation included four foreign varieties as a check: fertile variety V-385 from Poland, RxT from the USA, Hewessi 4 from Hungary, L. 17-66 from Australia and two domestic male sterile hybrid varieties (lines): V-112 CMS F₁ and V-97 CMS F₁ from North Macedonia created in the Scientific tobacco Institute - Prilep. The investigation was carried in the experimental field of the Tobacco Institute - Prilep in 2019. The trial was set up using the method of randomized blocks in four replications. Morphological traits belong to the group of quantitative (metric) properties and they primarily depend on the inherited genetic properties of the varieties, which are greatly influenced by the applied agrotechnical measures during the vegetation. Important indicator for determining the quality of tobacco is the insertion and the size of the leaf in green and dry condition. Therefore, the purpose of investigation of the Virginia varieties and lines was to present the characteristics of the middle belt insertions: length and width of the 5th, 10th and 15th leaf in green condition, height of the plant with inflorescence and the number of leaves per plant. Measurements of the investigated varieties and lines were made during the flowering period. The creation of new varieties of tobacco from these and other types of tobacco is a long-term program objectives in the Scientific Tobacco Institute –Prilep. The continuity of creating new varieties of tobacco has not been interrupted to date, which makes a great contribution to production. To obtain the significance of these investigations, the results were statistically processed and tested with LSD test. The best results were obtained with the lines V-112 CMS F₁ and V-97 CMS F₁, with statistical significance of 1% compared to the check in all examined traits.

Key words: *tobacco, leaf, length, width, varieties*

EFFECTS OF SOIL AMENDMENTS ON INCIDENCES OF BACTERIAL WILT AND TUBER YIELD OF POTATO AT DIFFERENT ENVIRONMENTS IN MALAWI

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Abstract

Potato bacterial wilt caused by *Ralstonia solanacearum* is a major threat to potato production in Malawi and sub Saharan Africa region. The incidence of the disease has been reported to be exacerbated under conditions of moisture stress, low soil fertility and low pH. Effects of soil amendment on bacteria wilt incidence and potato tuber yield were assessed in Malawi at Bvumbwe, Bembeke, Kandiyani and Lunyangwa research stations during 2020/21 and 2021/22 growing seasons. Five treatments including agricultural lime (3t/ha) and four rates of a Granulated Sulfur & Calcium Carbonate called CALCIPRIL; CALC25%, CALC50%, CALC100% and CALC150% were laid out in Randomized complete block design (RCBD) replicated three times. Data collected included disease incidence data collected at 70 days after planting (DAP) and weight of tubers were graded to market size and non-market size. Data was subjected to analysis of variance in R programming and means were separated by the least significant difference (LSD_{0.05}). Disease incidence showed an interaction between amendments and season at Bembeke ($P=0.007$). Soil amendment with lime and CALCIPRIL reduced incidence in all sites ranging 4 – 89%, the highest reduction was achieved by lime at Bembeke at 70 DAP. Marketable tubers yield showed interaction between treatments and season at Bvumbwe ($P=0.04$), highest being 10.02 tha^{-1} obtained in CALC150% in 2020/21 while non-marketable tubers showed interaction at Lunyangwa ($P = 0.02$) highest being 3.9 tha^{-1} recorded in CALC150% in 2021/22. Soil amendments reduced incidence and increased tuber yield at different sites leading to reduced pesticides and increase smallholders' income sustainably.

Key words: Amendment, Potato, Soil, Disease incidence, Bacterial wilt

EFFECTS OF SUBSTRATES ON GROWTH, YIELD AND TUBER QUALITY OF SWEET POTATO CULTIVATED USING SOILLESS CULTURE SYSTEM

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Abstract

The soilless culture system effectively promotes plant growth by facilitating water and nutrient uptake by plant roots. To increase sweet potato (*Ipomoea batatas*) production, we developed containerized planting in which tuberous roots were grown in solid substrates in the polybags supplied with a nutrient solution through an irrigation system. Five combinations of growth substrates were evaluated: 100% coir dust; 100% burnt paddy husks; 70% coir dust + 30% burnt paddy husks; 30% coir dust + 70% burnt paddy husks; and 50% coir dust + 50% burnt paddy husks. The sweet potato plants were harvested 90 days after planting. Plants grown in 100% coir dust gave the best yield compared to the other treatments. They produced the highest tuber yield (2788 g) compared to the plants grown in 100% burnt paddy husk which produced the lowest tuber yield (1174 g). Tubers obtained from 100% coir dust showed the highest Total Soluble Solid (TSS) value (12.1° Brix) and moisture content (76.73%) compared to other treatments. These results showed that sweet potato cultivated in coir dust substrates increased the tubers yield by 2.3 times compared to those grown in burnt paddy husks. Studies revealed that planting sweet potato in 100% or high coir dust substrates increased the plant growth, tuber yield and enhanced tuber quality compared to substrates containing high burnt paddy husk.

Keywords: *Sweet potato, soilless culture system, coir dust, burnt paddy husk, tuber.*

INFLUENCES OF HIGH TEMPERATURE ON VIGOUR OF MAIZE SEEDS CULTIVATED IN THE REPUBLIC OF MOLDOVA

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Abstract

The vigour test is a sensitive indicator of seed physiological quality that provides a precise identification of important differences in physiological potential of different batches of maize seeds with similar germination percentage. Taking into account global climatic changes, the main purpose of this study was to evaluate the changes in vigour of maize seeds at supraoptimal temperatures. The study included six maize hybrids of different maturity (FAO 100 - FAO 400) obtained in 2019 from the "Porumbeni" Institute of Crop Science, the Republic of Moldova. Germination percentage, shoot length (cm) and vigour index were determined after seven days of maize seeds germination at 25⁰C. The results revealed that the length of shoots had statistically significant differences between hybrids of early (P180) and intermediate (B203, P369) maturation ($p \leq 0.001$), as well as between hybrids of early (P180) and later maturation (P427) ($p \leq 0.01$). Initial seeds vigour of tested hybrids ranged from 402.42±43.63 to 554.20±12.84. The pre germination heat treatment of seeds at 50⁰C during 30 min led to a significant rise in the shoots length of germinated seeds, especially in intermediate maturing maize (FAO 200-300). At the same time, a diminution in the total number of germinated seeds caused a vigour modification of experimental batches as a whole. Depending on the physiological state of the hybrid, under influence of supraoptimal temperatures, the seeds vigour decreased by 1.14-2.05 times. According to the findings, the seed vigour test could serve as a presowing technique for estimation the resistance to high temperatures of different maize hybrids.

Keywords: *Maize hybrids, Seed, Vigour, Supraoptimal temperature.*

ISOPRENOID CONTENT OF PEACH *PRUNUS PERSICA* AND APRICOT *PRUNUS ARMENIACA* FRUIT CUTICULAR WAXES

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Abstract

Peach (*Prunus persica* L. Batsch) and apricot (*Prunus armeniaca* L.) are very popular drupe-type fleshy fruits from Rosaceae family, important to the agricultural economies of many countries. The majority of Rosaceae fruits are characterized with a relatively high content of isoprenoids (triterpenoids and steroids) occurring in their surface cuticular waxes. However, the data concerning the occurrence of these compounds in peaches and apricots are scarce. The aim of the present study was the determination of isoprenoid content in the cuticular waxes of peach var. 'Redhaven' and apricot var. 'Somo' cultivated in Poland. Chloroform-soluble wax extracts obtained from fruit samples were fractionated with the use of preparative adsorption chromatography and analyzed by gas chromatography-mass spectrometry (GC-MS). The profile of the identified compounds was similar in both fruits. However, some quantitative and qualitative differences were noticed. Triterpenoid acids (betulinic, oleanolic and ursolic acids) were the predominating fraction of isoprenoids identified in cuticular waxes of both fruits, however, they were 4-fold more abundant in peach. Moreover, dihydroxy acid of oleanane-type, maslinic acid, was identified only in peach, whereas ursane-type corosolic acid only in apricot wax. The fraction of the neutral triterpenoids was similar, composed primarily of oleanane- and ursane-type alcohols and aldehydes. Typical profile of steroids was identified in both fruits, however, stigmasterol was dominating in peach, whereas sitosterol in apricot. The total contents of isoprenoids in peach (approx. 90 µg/mg of wax extract) and apricot (approx. 27 µg/mg) cuticular waxes were found to be significantly less than in other Rosaceae fruits.

Keywords: *apricot, cuticular wax, peach, steroids, triterpenoids*

EFFECTS OF DIFFERENT SOIL AMENDMENTS ON CABBAGE GROWTH AND YIELD, IN THE SEMI-ARID CENTRAL NAMIBIA.

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Abstract

Semi-arid central Namibia is characterised by mostly sandy soils and scarce water resources, which hinder crop production. The study investigated the effects of soil amendments on cabbage growth and yield. Five soil amendments were used; biochar, compost, zeolite, be-grow and hoof and horn plus bone meal. Two irrigation levels were employed as main plots; full irrigation (79.618 m³) and reduced irrigation (39.620 m³), in a split-plot design. Each irrigation level had seven subplots, in three replications, constituting the five amendments, treated control (NPK) and the absolute control (untreated). Biochar, zeolite and be-grow were supplemented with NPK, while compost and hoof and horn plus bone meal were not supplemented. Plant height data was collected from week three after transplanting, at two weeks intervals, until cabbage head formation, after which the cabbage head girth growth was monitored and recorded. Cabbage head weight, head girth, stem girth, total heads formed and total marketable heads data was collected at maturity. An analysis of variance was run using STAR statistical software. The data means were separated at $p \leq 0.05$, for a significant difference. Biochar had significantly the highest total marketable heads, head girth, stem girth and plant height. Full irrigation had significantly high head girth and head weight. There was no considerable difference among amendments and between irrigation levels, on total heads formed. Further study needs to be carried out on the combination of soil conditioners and organic fertilizers e. g biochar X compost.

Keywords: *Sandy soils, semi-arid, soil amendments, cabbage growth, and cabbage yield*

**PATHOGENICITY OF *FUSARIUM OXYSPORUM* ISOLATES ON TOMATO
(*SOLANUM LYCOPERSICUM* L) AND THEIR ANTAGONISTIC EFFECT WITH
*TRICHODERMA HARZIANUM***

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Abstract

Pathogenicity test of *Fusarium oxysporum* isolates was carried out on two tomato varieties (UC 82B and Rio-grande) in a screen house located at the Teaching and Research Farm of Federal University of Agriculture, Makurdi during 2015 cropping season. The experiment was a 2 x 11 factorial laid out in Completely Randomized Design (CRD) and replicated three times. The *F. oxysporum* isolates tested were coded as: FoAs1, FoAs2, FoAg, FoNb, FoSb, FoAm, FoAk, FoOr, FoAd and FoUAM together with an uninoculated control. All the isolates of *F. oxysporum* tested were pathogenic, causing wilt on the plants from 3 weeks after inoculation (WAI), with severity of wilt been significantly higher ($P \leq 0.05$) in FoUAM. *In-vitro* tests showed antagonistic effects of *Trichoderma harzianum* on *Fusarium oxysporum* L. isolates. Growth inhibition was significantly higher ($P \leq 0.05$) when *T. harzianum* was introduced two days before inoculation of *F. oxysporum*. Interaction shows that *T. harzianum* introduced two days before inoculation of *F. oxysporum* gave better inhibition of all the *Fusarium* isolates tested except isolates FoAd and FoAg compared with when the antagonist was introduced at the same time and when it was introduced two days after inoculation of *F. oxysporum*. Also, *T. harzianum* ($P \leq 0.05$) totally inhibited the growth of isolates FoAg, FoAs1, FoNb, FoOr and FoUAM but not those of FoAd, FoAk, FoAm, FoAs2 and FoSb. It is therefore recommended that *T. harzianum* be used in the management of fusarium wilt of tomato.

Key words: *Fusarium oxysporum*; *Inhibition*; *Isolates*; *Pathogenicity*; *Tomato*; *Trichoderma harzianum*

EFFECT OF BIOGENICALLY SYNTHESIZED SILVER NANOPARTICLES ON GERMINATION, BIOCHEMICAL AND YIELD ATTRIBUTES OF WHEAT (*Triticum aestivum* L.)

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Abstract

The use of nanotechnology can ensure food security via improving crop production. Silver nanoparticles (Ag NPs) have definite potential to enhance growth and yield of wheat. Various concentrations of Ag NPs inconsistently affected germination and seedling growth. Use of 20 ppm Ag NPs predominantly improved germination percentage, germination index, shoot fresh weight, shoot and root dry weight of wheat. Silver nano-particles have significant impact on biochemical traits of wheat. Maximum free proline, total soluble protein, chlorophyll stability index and total soluble sugar were recorded at 40 ppm of Ag NPs and then started declined when concentration was increased. Enzymatic activities (SOD, POD, CAT and MDA content) of wheat increased by the application of Ag NPs @ 40 ppm and tends to decline with higher concentrations of Ag NPs. Green house results revealed that Ag NPs enhanced growth and yield of wheat crop plants at lower concentrations (40 ppm of Ag NPs) while higher concentrations have detrimental effects. Silver nanoparticles can modify plant physiology to greater extent. Silver nanoparticles can be employed to improve germination indices, physiological attributes of plants to enhance resistance and stress tolerance which ultimately result in boosting growth and yield of crop plants.

Keywords: *Silver nanoparticles, Proline, Sugars, Enzymatic activities, Yield, Wheat.*

AGRONOMIC SEED PRODUCTION AND OIL QUALITY EVALUATION OF VARIOUS BRASSICA SPECIES GROWN UNDER SEMI-ARID CLIMATIC CONDITION

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Abstract

Brassica crops (rapeseed and mustard) are important oil seed crops in the world. Increase in the demand of edible oil due to the ever-increasing population has threatened the sufficient availability of edible oil. For this purpose, a two year experiment was laid out at experimental farm of Bahauddin Zakariya University, Bahadur Sub-Campus Layyah-Pakistan. Twenty brassica genotypes *viz.*, Holya-401, Faisal canola, AARI-Canola, Hop-09, RBN-04722, Panjab Sarsoon, RBN-11049, Mulki, PARC-Canola hybrid, Pakola, Canola Raya, Con-II, 19-H, Durr-e-Nifa, RBN-03046, Shiralee, Dunckled, Bulbul, Nifa Gold and Abasin-95 were evaluated and experiment was repeated over the time for two years. Analyses of variance revealed significant ($p < 0.05$) differences among all the studied attribute of brassica genotypes. Moreover, year effect was also found significant due to change in weather condition and rainfall of the two years. Results revealed that maximum number of seeds/siliqua per plant, biological and seed yield were found in genotype 'Dunkled' and oil seed quality was observed in genotype 'Nifa-Gold'. In conclusion, the both genotypes 'Nifa-Gold' and 'Dunkled' showed improved productivity, high yield and better oil quality under semi-arid climatic condition in Pakistan. Variability in brassica genotypes may be a good approach for breeding programs to obtain good production and oil quality under various environmental conditions.

Keywords: *Brassica genotypes, oil quality, seed yield, semi-arid region.*

CO-APPLICATION OF ZINC AND SILICONE TO MITIGATE THE ARSENIC TOXICITY IN WHEAT

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Abstract

Wheat is used as a food crop mostly for its good taste and source of calories, protein and vitamins. Low-quality wheat and flour-milling by-products are used as a source of animal feed. Micronutrients are used for the development and regulation of vital physiological processes of the plant. For this study, we hypothesized that soil application of micronutrients would improve seed yield and nutritional quality of wheat and would help to mitigate the arsenic toxicity in wheat. Therefore, a pot experiment was conducted to check the individual and combined effects of zinc and silicon along with two arsenic levels i.e. 100 μM and 200 μM on wheat growth and productivity. All treatments were applied at tillering stage of wheat. The results indicated that maximum plant height, number of tillers, spike length, flag leaf area, spikelets per spike, and 100-grain weight were recorded in combined application of zinc and silicone (Zn+Si) as compared with other treatments applied. Not only that they gave maximum growth and yield, also in combination they mitigate the arsenic toxicity in wheat. Individual application of arsenic level 200 μM had lowest yield value as compared with other treatments. The application of micronutrient also improved the grain zinc and silicon contents and nutritional quality of wheat. In conclusion, wheat cultivars should be grown with the combined application of Zn+Si at recommended doses to achieve higher physiological growth, better seed and nutritional quality and to earn higher net benefits from wheat cultivars under arid climate of Layyah Punjab, Pakistan.

Keywords: *Physiological processes, wheat plants, arsenic toxicity, nutritional quality.*

EFFICACY OF PLANT ACTIVATORS ON MINERAL PROFILE OF TOMATO INFECTED WITH FUSARIUM OXYSPORUM

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Abstract

Tomato (*Lycopersicon esculentum L.*) is second largest vegetable after potato. Several biotic and abiotic factors are involved in limiting the yield of tomato but Fusarium wilt caused by *Fusarium oxysporum* f.sp *lycopersicae* is the most destructive. It causes 10-90% losses in temperate region of the world. Symptoms of this disease ranges from leaf yellowing to plant death due to obstruction of xylem vessels. So the present study was conducted for activation of defence mechanism of tomato against the Fusarium wilt. The experiment was conducted in research area of the Department of Plant Pathology, University of Agriculture, Faisalabad under randomized complete block design (RCBD). The activators like ferric chloride, KH₂PO₄, calcium chloride and salicylic acid were applied @ 0.5, 1 and 1.5% concentration at 10 days interval. For the assessment of activation of defence mechanism of treated plant ionic contents (N, P, K, Na, Ca, Mg) was also analyzed. Result showed that Calcium chloride gave the most effective result with 5.2 % D.I at 1.5% concentration by increasing the ionic content Ca(4.76), Mg(3.17), N (2.52), P (3.14), K (2.16) and Na(0.84) . So, it was concluded that activation of defence mechanism by the plant activator is the most recent, environment friendly and economical approach for the management of disease.

Keywords *Tomato, Fusarium Oxysporum, Activators*

GENOTYPE BY ENVIRONMENT INTERACTION INFLUENCE ON FUNCTIONAL MOLECULES (A-TOCOPHEROLS AND STEROLS) ACCUMULATION IN SUNFLOWER OIL

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Abstract

Tocopherols and sterols are non-dietary functional molecules in sunflower oil, which act as antioxidants, reduce cholesterol and improve immunity against diseases. The present study was designed to determine α -tocopherol and sterols contents in 13 high and 2 low oleic acid sunflower hybrids across 2 seasons (spring and autumn) and 4 locations under subtropical conditions of Pakistan. The results showed that α -tocopherol and sterols contents varied across the seasons and locations. High oleic acid hybrids yielded 38% higher α -tocopherol content than low oleic acid hybrids. Hybrids such as H4 and H5 are considered stable due to comparatively close values of α -tocopherol and sterols contents across all 4 locations when compared with standard checks and other hybrids during spring season. Hybrids H8, H4 and H5 also manifested higher magnitude of heterosis for α -tocopherol and sterols contents that may be due to overdominance gene action. Breeding lines such as B.116.P, B.112.P and RH.365 were positive combiners for the studied traits and thus may carry positive alleles for both α -tocopherol and sterols traits.

Key words: *Hybrid vigor, overdominance, functional molecules, oil contents*

MAKING SALINE SOILS PRODUCTIVE: CAN CO-APPLICATION OF PLANT GROWTH PROMOTING BACTERIA & BIOCHAR BE A SOLUTION? RESULTS OF A WHEAT TRIAL GROWN ON A SALINE SOIL

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Abstract

Soil salinity is a global problem that needs to be tackled for global food security. Plant growth promoting bacteria (PGPR) and biochar have been shown to increase crop productivity and soil fertility when applied separately. Their co-application could act synergistically in increasing crop productivity and soil quality of saline soils. Therefore, we studied potential effect of combined application of PGPR and biochar on wheat growth and a naturally saline soil quality parameters. Wheat was grown in naturally saline soil after incubating with two PGPRs without and with biochar (1%) till maturity. Both the PGPRs were able to produce IAA and solubilize phosphorus. Based on the 16S rRNA gene sequence analysis PGPR1 and PGPR2 isolates were closely related to *Bacillus thuringiensis* (99%) and *Bacillus tropicus* (99%) respectively. Combined *Bacillus thuringiensis* & biochar induced synergistic effects on soil quality parameters as well as wheat growth and yield, while no such effects were noted in case of *Bacillus tropicus*. It reduced EC to 5.76dSm^{-1} as compared to control treatment 7.85dSm^{-1} . Sodium/potassium (Na/K) ratio in soil was significantly decreased by 72.5% than in control treatment. Combined *Bacillus thuringiensis* & biochar significantly increased β -glucosidase, alkaline phosphatase, and leucine aminopeptidase activities thereby leading to enhanced nutrient availability in soils. Moreover, this combination also increased microbial biomass by 77%, available phosphorus by 20.59% and mineral nitrogen content by 38% in soil as compared to control. These improvements in soil activity and quality resulted in increase in number of spikes by 26.7%, grain yield by 37.9%, and straw by 21.81% when compared to control treatment. Application of PGPRs alone did not result in yield enhancement. Overall our results indicate that combining biochar with as suitable PGPR can substantially increase crop yield as well as soil quality.

Keywords: *Soil Salinity, Nutrient cycling, Extracellular enzymatic activity, soil microbial biomass.*

EFFECT OF HERBIVORE-INDUCED PLANT VOLATILES (HIPVs) ATTRACTANT ON CANOPY ARTHROPODS OF THE OLIVE AGROECOSYSTEM

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Abstract

The olive orchard is considered to have a high level of arthropod diversity which provides the olive canopy with multiple services that improve the quality and the quantity of olive production. The present study aimed to test the effectiveness of HIPV-baited traps (commercial product MagiPal[®]) on the arthropod diversity in the olive agroecosystem. A reliable assessment methodology was applied for monitoring the level of arthropods biodiversity, prioritizing the main important functional groups (pests and natural enemies). The study was conducted on an organic farm on the island of Crete (Greece). A passive trapping methodology was tested by applying transparent sticky traps with and without HIPV bait. The attractant was applied as a continuation of the previous study to monitor and compare the attractant's effects with regards to the total arthropod, and other diversity indices (abundance and richness). The results of this study gave no statistically significant differences between HIPV-attractant traps and control traps for all identified orders with a slight tendency of MagiPal[®] to have an attraction effect on some beneficial species. Several factors, such as the short-term scale, dosage, and specificity of the applied cues, adversely influenced the amount of the arthropod community under the attractant's influence. Further research on the HIPV-based attractants regarding their effective concentrations and time of application of active compounds is suggested due to their promising potential impact in the manipulation of the diversity of beneficial arthropods of the olive canopy.

Keywords: *functional agrobiodiversity, transparent sticky traps, herbivore-induced plant volatiles, methyl salicylate*

UP-REGULATED PROTEINS IN PHOTOHETEROTROPHIC AND MIXOTROPHIC *C. SOROKINIANA*, *C. SACCHAROPILA* AND *C. VULGARIS* CELLS

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Abstract

Unicellular green algae represent a highly specialized group of microorganisms that are easily adaptable to various environmental conditions. The environmental factors ensuring proper cell functions comprise e.g. nutrients contained in the culture medium. Carbon as a component is crucial for microalgae, as it plays an important role in the cell structure, biochemistry, and nutrition. It influences not only the process of photosynthesis but also in cell divisions and the biochemical composition. The addition of carbon source in algal cultivation has a significant impact on the production of microalgal biomass and metabolites synthesis. Mixotrophic and photoheterotrophic cultivation modes, promote the synthesis and accumulation of specific proteins. The aim of this work was to investigate the impact of autotrophic, photoheterotrophic and mixotrophic modes on growth parameters, productivities of cell components and biochemical composition of three *Chlorella* species with special consideration the protein profiles detected by SDS-PAGE gel electrophoresis and two-dimensional gel electrophoresis with MALDI-TOF/TOF MS. The mixotrophic mode of cultivation using agro-industrial by-product stimulated growth of all *Chlorella species* which was confirmed by the highest specific growth rates and the shortest biomass doubling times. Mixotrophic cultivation modes of *Chlorella sorokiniana*, *Chlorella saccharophila* and *Chlorella vulgaris* produced high amount of protein rich-biomass with reduced chlorophyll a, chlorophyll b, carotenoids, and carbohydrates content. An increased accumulation of proteins involved in the cell's energy metabolism and carbon uptake, photosynthesis process, intracellular movements and stress response was noticed in three *Chlorella* species growing photoheterotrophically and mixotrophically.

Keywords: *Mixotrophy, photoheterotrophy, Chlorella, proteins, proteomics.*

YIELD AND HEALTH STATUS OF FABA BEAN SEEDS GROWN IN POLAND

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Abstract

Faba beans is characterized by high nutritional value, in terms of both energy and protein content, which makes it suitable for food and feed production. Fungal diseases are among the key biotic factors responsible for a decline in faba bean yields. In this study, yield and health status of faba bean seeds grown in Poland, were determined. The study revealed that temperature and precipitation influenced the development and yield of faba beans. The seed yield was considerably higher in the region of Warmia and Mazury than in the region of Lower Silesia. The determinate-growth cv. Granit yielded higher than the indeterminate-growth cv. Olga in the region of Warmia and Mazury. In the region of Lower Silesia, cv. Granit yield was higher only in 2011, whereas cv. Olga was characterized by higher seed yields in 2012 and 2013. Temperature exerted the greatest effect on the yield of faba beans during inflorescence emergence, whereas the effect of precipitation was the maximum at the 4–5 leaves unfolded stage and at the end of flowering. Faba bean seeds were colonized by pathogenic and saprotrophic fungi. Pathogens were represented by the genera, *Ascochyta*, *Botrytis*, and *Fusarium*. In Warmia and Mazury and Lower Silesia, seeds of the cv. Granit were more severely infected by fungi than cv. Olga. The levels of seed colonization by pathogenic and saprotrophic fungi were higher in faba beans seeds grown of Warmia and Mazury. The occurrence of saprophytic, pathogenic fungi was influenced by temperature and precipitation in the flowering stage.

Keywords: *yield, seed disease, temperature, precipitation*

CHARACTERISTICS OF THE CONTENT OF LIPOPHILIC COMPOUNDS IN PROPOLIS AND SELECTED TYPES OF HONEY

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Abstract

Honey was one of the first foods of humans originating directly from nature. Nowadays, many studies are devoted to the composition and medicinal properties of honey. In this work, the analysis of lipophilic compounds, including sterols and triterpenoids, in four types of honey: buckwheat, linden flower, colza, honeydew honeys, and propolis was performed. The analyses were made by gas chromatography-mass spectrometry method (GC-MS) in diethyl ether extracts obtained from the samples of honeys and propolis. Aliphatic compounds (fatty acids, long-chain alkanes); phytosterols (campesterol, sitosterol, stigmaterol); steroid ketones (sitostenone, tremulone); neutral triterpenoids, e.g., alcohols as amyryns and betulin, ketone friedelin (only in linden flower honey); triterpenoid acids, e.g., oleanolic, ursolic, maslinic, corosolic and pomolic acids; and vitamin E were identified. The highest total content of triterpenoids and steroids was noticed in propolis (1115 $\mu\text{g/g}$), linden flower honey (68 $\mu\text{g/g}$), followed by buckwheat (58 $\mu\text{g/g}$) and colza (39 $\mu\text{g/g}$) honeys, whereas the lowest content was found in honeydew honey (22 $\mu\text{g/g}$). Sterols and triterpenoids can be considered as bioactive compounds, however, they occur in honey in too small amounts to exert directly health-promoting or therapeutic activity, although they can act synergistically with other compounds, as phenolics. Moreover, phytosterols and triterpenoids, as compounds synthesized by the plants, can potentially be applied as the markers of the origin of honey. The comparison of antioxidative potential of tested honeys and propolis with the use of DPPH test showed that propolis has the highest antioxidant properties, followed by the buckwheat honey.

Keywords: *honey, steroids, triterpenoids, propolis*

THE QUALITY OF THE SPRAYING PROCESS DEPENDING ON THE CHARACTERISTICS OF THE SELECTED PLANTS

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Abstract

The aim of the study was to determine the degree of coverage of the sprayed objects depending on the characteristics of selected plants with the use of single and double-stream nozzles. Two-stage studies were performed under laboratory conditions. In the first stage, the coverage of the sprayed objects was measured. The sprayed object was an artificial plant on which the vertical and horizontal sprayed surfaces were designated. Two nozzles representing a different mode of operation were selected for the tests. In the second stage, experiments were carried out in the field of plant spray characteristics. The research was carried out on a test stand that enables scanning of horizontal and vertical surfaces of plants. On the basis of the measurements, the coefficient of the position of the spraying areas was calculated. A different range of the degree of coverage of vertical and horizontal surfaces was observed depending on the nozzle. It can be concluded that the combination of nozzle and spray characteristics of plants determine a potential coverage with spray liquid.

Keywords: spraying, plants, nozzles.

CHARACTERISTICS OF SELECTED PLANTS IN TERMS OF THE SPRAYING PROCESS

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Abstract

The aim of the study was to determine the characteristics of the spraying plants. The research was carried out at the Institute of Agricultural Engineering at the Wrocław University of Environmental and Life Sciences. Experiments were conducted on a measurement stand, with the scanner Smarttech3D Universe 5Mpix. The scans were performed with an accuracy of up to 80 μm at a sampling of 41 points per mm^2 . On the basis of the cloud of points 3D models were generated. The horizontal and vertical surface areas were calculated using dedicated Smarttech3Dmeasure software. On the basis of the analysis of the results obtained, it was found that the plants studied were characterised by a wide variety of parameters which were used to determine the spray characteristics. In addition, it was observed that the spray characteristics of the plants could be determined based on W_{sp} spray factor as a ratio of the size of vertical surfaces to horizontal surfaces.

Keywords: Plants, sprayinb, software.

TRITORDEUM GRAIN A SOURCE OF ESSENTIAL MINERALS IN THE HUMAN DIET

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Abstract

Cultivated Tritordeum (*x Tritordeum martinii* A. Pujadas, nothosp. nov.) is a fertile hexaploid plant ($2n=6x=42$, AABBHchHch) that was developed in the late 1970s in Spain by crossing durum wheat (*Triticum durum* Desf.) with wild barley (*Hordeum chilense* Roem. and Schult.), hence the name *Trit(icumH)ordeum*. Tritordeum grain is known for its high content of protein, carotenoids and polyphenols, but its mineral composition has not been analyzed to date. The experimental material comprised of 11 breeding lines of Tritordeum, two reference cultivars of durum wheat, and one hullless barley cultivar. The thousand kernel weight (TKW) of the studied Tritordeum lines was 23% lower than in durum wheat and more than 18% lower than in barley. Tritordeum grain contained around 24% more ash than durum wheat. During the entire two-year study, the concentrations of the 31 analyzed elements were similar to those reported in various small grain cereals in the literature. Tritordeum grain was characterized by a very high content of potassium and magnesium which was more than 16% and 6% higher, respectively, than in durum wheat, and 27% and 17% higher, respectively, than in hullless barley. In comparison with the reference durum wheat and barley cultivars, Tritordeum was also more abundant in copper (by 24% and 62%, respectively), zinc (by 11% and 17%, respectively) and cobalt (by 24% and more than 314%, respectively). The limits for the lead and cadmium content of grain were not exceeded.

Keywords: *Tritordeum*, *microelements*, *macroelements*, *grain*.

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TIRE FOOTPRINT EVALUATION USING THE 3D SCANNING METHOD

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Abstract

This paper presents results of research related to measurements of the contact area of selected agricultural tires on sandy loam. In the experiment two tires with the same size and different internal structure (radial tire and bias-ply tire) were tested. They are used in agricultural trailers, spreaders, or balers, i.e., machinery causing soil compaction. The experiment was conducted under different conditions; three levels of inflation pressure, five levels of vertical load were used; experiment was carried out at one value of actual humidity of the soil. The experiment was conducted in laboratory using soil bins and special tested bench, which allowed change of experiment conditions. Firstly, the tire footprint on the soil was made, then it was scanned using 3D scanner. The effect of this operation was three-dimensional image of the tire footprint on the soil, which gave the possibility to analysis of tested parameters: contact area of tire on the soil, tire footprint width, tire footprint length. It was observed that contact area increased after increasing of the vertical load and inflation pressure, however with other values depending on the internal structure of the tested tire. Obtained results will be useful in prediction of the unit pressure generated on the soil. In turn, the result can be useful in agricultural practice.

Keywords: *Contact area, Tire footprint, Agricultural tire, 3D scanning.*

ANTIOXIDANT POTENTIAL AND PHOTOSYNTHETIC PIGMENTS IN KALE (*BRASSICA OLERACEA ACEPHALA SABELLICA*) FROM DIFFERENT SOURCES

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Abstract

Kale (*Brassica oleracea* L. var. *acephala*) is a cruciferous vegetable terms as a ‘superfood’ due to its wide range of nutrients that might help in prevention of various health problem. The nutritional and health benefits of those plants were known since antiquity but they are currently not popular vegetables in the mass diet. Kale has an unstable composition after harvesting, and moreover, very often due to its taste, it is subjected to a thermal treatment which affects its pro-health properties. Broad perspectives of plant biotechnology find application in traditional agriculture for many species. This study aimed to evaluate the antioxidant potential and content of photosynthetic pigments in kale leaves obtained from *in vitro* culture, pots cultivation and commercial source. For micropropagation shoots were transferred for 4 weeks on MS medium supplemented with benzylaminopurine. Culture was maintained at $22\pm 1^\circ\text{C}$ under 14/10 photoperiod a quantum irradiation intensity of $120\ \mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$. Pots experiments were performed in comparable growth conditions. Antioxidant potential and pigments content was determined spectrophotometrically using DPPH reaction and methanol extraction, respectively. The results showed that kale from *in vitro* culture indicated the highest antioxidant potential in comparison to kale from pots cultivation and commercial source. That was negatively correlated with the content of photosynthetic pigments. Kale from commercial source, with the lowest antioxidant potential, indicated the highest content of chlorophyll a, chlorophyll b, and carotenoids.

Keywords: *antioxidant potential, carotenoids, chlorophylls, in vitro culture, kale.*

THE EFFECT OF INCREASED TEMPERATURE AND LIGHT ON THE DEVELOPMENT OF WHEAT AND MAIZE

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Abstract

The greenhouse effect and drought have emerged as one of the greatest global problems in recent decades. Global warming exerts a negative influence on crops. The adverse consequences of climate change, including changes in rainfall distribution patterns and temperature, have mounted in recent years. On the global cereal market, wheat is regarded as a particularly valuable crop species due to its chemical composition and the specific technological properties of grain. In turn, maize is not only a valuable fodder crop that is highly suitable for feeding livestock, but it is also widely used in the industrial sector and the food processing industry, and its potential for energy generation has also been recently recognized. The aim of this greenhouse experiment was to analyze the effects of temperature and light on the development and health status of maize and bread wheat. The experiment was established in two greenhouses with mean daytime temperature of 22°C and 32°C. Spring bread wheat (cv. Tybalt) and maize (cv. Subito) were sown in pots. Selected biometric parameters and the health status (Normalized Difference Vegetation Index, NDVI) of wheat and maize plants were determined after 27 days of growth. Plants growing at a higher temperature developed more rapidly and were characterized by higher turgor pressure. The value of the NDVI was significantly higher in maize than in wheat, and higher greenhouse temperature led to a significant increase in this index. At 27 days after the sowing date, the height of maize plants, which were grown at the higher temperature was about twice higher than the height of plants grown at the lower temperature. Wheat cultivated at the higher temperature was grown slowly, but the tillering phase of crop advanced faster and the wheat leaf blades were better developed.

Keywords: *Maize, Wheat, Temperature, Light, Biometric parameters.*

USING THE 3D SCANNING METHOD TO THE EVALUATION OF AGRICULTURAL TIRE DEFORMATION

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Abstract

This presentation concerns evaluation of agricultural tire deformation using a 3D scanner. The research objects were two tires with the same size and different internal structure- they were used in agricultural trailers, spreaders, or balers, i.e., machinery causing soil compaction. In the experiment three levels of inflation pressure and five levels of vertical load were used. Loaded tire with each inflation pressure was scanned using 3D scanner - the effect of this operation was three-dimensional image of the tire part (near the place of contact with the surface). The next step was the creation of vertical and horizontal cross-sections of the tire profile, which gave the possibility to analysis of tested parameters: profile height, location of point of maximum tire deflection, width of the tire profile and the area of horizontal cross-sections. Based on conducted research it was stated that both air pressure and vertical load had significant impact on all analyzed parameters – this tendency was observed for both tires. The present research sets out the principles of measuring and analyzing the results for the non-deformable surface. Due to the fact that the 3D-scanning methods are becoming more popular the presented method is rational for further use on deformable surface (soil). Moreover, it can be used to evaluate of deformation both the tire and soil - it will be helpful at the choice of optimal conditions of agricultural tire use.

Keywords: *Radial tire, Bias-ply tire, Contact area, 3D scanning, Tire deformation.*

EFFECT OF PGR'S AND COLD TREATMENT ON THE GERMINATION AND PLANTLETS DEVELOPMENT OF *ECHINACEA PURPUREA*

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Abstract

Echinacea purpurea is an important medicinal plant with a considerable economic value. Although it is a worldwide used food supplement, the low germination capacity of the seeds causes difficulties in cultivation of the plant. The aim of this study was to find an effective and inexpensive method that does not influence plant development, but increases the germination capacity. Seeds were placed on multi-compartmental germination trays filled with peat. The following treatments were used: the control group [C], cold treatment [ColdT] - 14 days at 4°C, cold treatment in moist peat [ColdT+P], gibberellin [GA₃] (150 ppm), benzyladenine [BA] (10 ppm), and combination of cold treatment with plant growth regulators [ColdT+BA, ColdT+GA₃]. Each treatment had four replications of 25 seeds. Fresh and dry biomass, root-, shoot- and leaf blade length were measured on day 21 and 42. Seed quality parameters such as germination percentage, mean germination time, germination index, uniformity of germination were analyzed. Results showed significant differences in case of 21 days old plantlets only in leaf blade length. ColdT+BA plantlets had significantly longer leaf blades than C and ColdT plantlets. ColdT+BA presented longer shoots, while ColdT+P plantlets had longer shoots and higher biomass than C plantlets on day 42. Although ColdT+GA₃ treatment resulted higher germinability, it had no significant effects on the other parameters. Results show that ColdT+P treatment had positive effect on several measured parameters, but caused a higher number of abnormal seedlings than other treatments. Further research is necessary to confirm the efficiency of ColdT+GA₃ treatment on germination.

Keywords: *Echinacea*, germination, prechilling, seed dormancy, benzyladenine, giberellin.

AMARANTHUS CAUDATUS AS A PUTATIVE BIOENERGY PLANT FOR PREPARATION OF BIOCHAR TO ENHANCE BIOMASS PRODUCTION

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Abstract

Conversion of low-density wood into biochar faces many problems and results in ash formation. Development of three-container indirect heating retort can help to combat with this problem and could lead to production of good quality biochar. To validate, the *Amaranthus spp.* biomass has been dried, ground <0.1 mm and put it in a small container which was placed in a bigger container and finally surrounded by a large stainless-steel container which was filled with feedstock and allowed to combust for two hours under limited oxygen condition. Analysis of prepared biochar showed alkaline pH, high water holding capacity and electrical conductivity. Pot scale study was performed on *Amaranthus caudatus* L. var. *gibbosus rubra* which showed that application of 1% biochar has not only enhanced fresh and dry shoot biomass but also improved biometric growth parameters (length of shoot and number of leaves) as compared to control plants. The study showed that the application of a low dose of biochar from *Amaranthus spp.* improved the growth of *A. caudatus* plants and thus increased the lignocellulose content which can be used for bioenergy production.

Keywords: *Amaranthus*, *biochar*, *retort*, *plant biomass*, *lignocellulose*.

BIOCHAR BASED BACTERIAL BIOFERTILIZER PROMOTES GROWTH AND MITIGATES COPPER TOXICITY IN *BRASSICA OLERACEA*

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Abstract

The interest to bacterial biofertilizers (BFs) is currently increasing since their application is environment friendly and cheaper in comparison with chemical fertilizers. BFs application reduces the metals availability in the soil through chelation, thereby reducing the toxicity of pollutants. The aim of the research was to study the effect of BF based on biochar and metal tolerant plant growth promoting rhizobacteria (PGPR) on growth parameters, copper accumulation and lipid peroxidation level in *Brassica oleracea* L. *Bacillus altitudinis* strain TF16a isolated from the rhizospheric soil of *Tussilago farfara* L. growing close to copper smelter was used to prepare the inoculum. To obtain BF, liquid inoculum of PGPR (10^8 CFU mL⁻¹) was mixed with sterile substrate. Plants were grown in pot for 30 days. In the control substrate and with the addition of BF, the copper content was two times lower than the maximum permissible concentration for Russia. It was found that combined action of BF with Cu had a positive effect on the growth parameters in *B. oleracea*. Copper application led to the significant increase in its accumulation in shoot and root which was accompanied by the increase in malondialdehyde content in cabbage leaves. The combined action of BF and Cu reduced Cu accumulation and mitigated peroxidation processes. Thus, it can be concluded that biochar based biofertilizer promoted growth and alleviated copper toxicity in *B. oleracea*.

Keywords: *Bacillus altitudinis*, cabbage, biochar, plant growth, agrobiotechnology .

IDENTIFICATION OF CMS AMONG BREEDING ACCESSIONS OF BRASSICACEAE FAMILY

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Abstract

Genetically controlled trait of cytoplasmic male sterility (CMS) is a benefit that is used to perform accurate crossing between parental lines to produce F1 hybrid seeds. The most widespread type of CMS is *Ogura* that was found out in Japanese radish genotype. This trait was successfully transferred in different genotypes of brassicas. As it was well shown the cytoplasmic gene *orf138* causes the abnormal development of pollen. Moreover, nuclear Rf genes that restore the plant fertility are shown to be regulating the action of cytoplasmic *orf138*. All these genes can be now identified among breeding accessions carrying genetic factors responsible for male sterility. Accessions from Brassicaceae family including such species as *R. sativus*, *B. oleracea*, *B. rapa*, *B. juncea*, *B. napus* were studied for a presence of CMS. Seven different CMS types (*Ogura*, *Ogura-NWSUAF*, *nap*, *pol*, *cam*, *rad*) were revealed. The different PCR-products, which were associated with CMS-types, confirmed the presence of three mitochondrial genes *orf138*, *orf222*, *orf224* in studied accessions. Two genes (*orf138* and *orf222*) were discovered in a sterile napa cabbage accession that corresponded to *Ogura-NWSUAF*-type. All accessions with CMS *Ogura* were proved to possess gene *orf138*, A-type (other nine types of *orf138* are previously discovered). Only accession of white head cabbage Tekila F1 carried a new allelic variant of the gene containing a 39-bp deletion and two nonsynonymous substitutions. The analysis of fertility-restoring genes (Rf) showed that, comparing with cabbage genotype, the radish accessions had several alleles at the Rf locus.

Keywords: *Cytoplasmic male sterility (CMS), orf138, Radish, Hybrid F1.*

SMART AGROECOLOGICAL DSS FOR DURUM WHEAT AGRI-TECHNOLOGIES WITH OPERATIONAL ADJUSTMENT BY IoT MONITORING DATA

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Abstract

There is developing the intelligent DSS for agroecologically rational choice of variety and for localization/operational adjustment of flexible elements of applied durum wheat agricultural technologies considering the agroecological features of the soils of a particular site with their operational adjustment by IoT monitoring data of air and soil temperature and moisture, crop height and vegetation indexes. For testing and verification of the developing DSS, the results of a system analysis of field experiments conducted in triple repetition according to a uniform design with 4 varieties of durum wheat have been used for two variants of agricultural technologies on representative 1-hectare plots at the regional agricultural institutions' experimental fields with Chernozems voronic (medium-thick medium- and low-humus (clay-)loamy ones) in the RF Volga and Southern Ural regions. The developed DSS shows significant changes in the yield of durum wheat under the conditions of choosing different zoned varieties (by 2-8 dt/ha), land plots of different exposures, steepness and part of the slope (by 1-4 dt/ha), different subtypes of soils of the forest-steppe and steppe zones (by 1-4 dt/ha), different sowing dates (by 1-6 dt/ha), various probabilistic scenarios of precipitation distribution by growing season and main phenological phases of durum wheat development (by 2-10 dt/ha). The verified algorithms for the analysis of micro-climatic information using data from digital relief models and the calculation of the predicted yield by 1st and 2nd limiting agroecological factors (PAR/sum of active temperatures and precipitation/estimated

Keywords: *Smart agroecological DSS, Durum wheat, Agricultural technologies, Chernozem, IoT monitoring*

POLLEN FORMATION IN SUNFLOWER HYBRIDS ON THE BASIS OF CMS

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Abstract

In externally fertile plants, the quality of the pollen may be different, and it is possible to distinguish the so-called "semi-fertile" forms. This is typical for sunflower F₂ hybrid populations from crossing CMS PET1 line and restorer lines. We have characterized the fertility/sterility manifestation in a sample set of 17 F₂ and 7 F₃ genotypes derived from a cross between the CMS line VIR 116A and a restorer line VIR195. The segregation pattern for fertility/sterility in the original F₂ population of 262 genotypes fitted three (fertile): one (sterile) model that supports the hypothesis on controlling the fertility restoration by a single locus (putatively *Rf1*). Each plant was phenotyped under field conditions and genotyped using SSR marker ORS511 linked to the *Rf1* locus. After flowering, the fertile or sterile plants were registered. The pollen of fertile and chimeric plants was stained with acetocarmine. F₁ plants produced approx. 90% of fertile pollen. Among F₂ plants examined, five plants were classified as purely fertile, seven as sterile, three as semi sterile, and two as chimeric ones. Among the F₃ plants three fertile, three sterile, and one chimeric plant have been noted. The chimeras possessed fertile flowers in the 1st to 3rd cycles of flowering, and further to the center the flowers were sterile. In most cases, fertile and chimeric plants possessed the ORS511 marker whereas sterile plants lacked the marker. The occurrence of the marker in sterile genotypes, and the absence of it in fertile ones can be a consequence of recombination events.

Keywords: *pollen fertility, CMS, sunflower, SSR marker ORS511, Rf1 gene.*

AGRO-MORPHOLOGICAL BASED GENETIC DIVERSITY ANALYSIS AMONG FABA BEAN (*VICIA FABA* L.) ACCESSIONS UNDER SAUDI ARABIA CONDITIONS

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Abstract

Faba bean is an important grain legume crop in the world. Using faba bean genetic breeding resources, contributing more to genetic diversity based on agronomic and morphological characters might be important to increase selection indices for the improvement of yield. Moreover, the breeding program gives better results with a high magnitude of genetic resources and diversity among available accessions and exploring the genotypes for high yield. For this purpose, we determine the genetic diversity of 144 faba bean accessions collected from different parts of the world growing under Saudi Arabia conditions and evaluate them based on an agro-morphological basis. The results showed a great range of variability for all the qualitative characters except growth habit (determinate 1.3%; indeterminate 98.7%) and pod shattering (non-shattering 99.40%; shattering 0.6%). The qualitative characteristics i.e., leaflet size, stipule spot pigmentation, flower ground color, the intensity of streak, wing petal colors, pod colors, pod angle, hilum color, pod shattering, ground color of testa, and seed shape also recorded high diversity among faba bean accessions. The principal component analysis (PCA) results showed the highest 95.32% diversity coming from three PCs, and dendrogram results divided faba beans into eight distinct groups based on their origin. Moreover, the cluster results group genotypes of faba beans were usually based on the origin and genetic history. Most accessions are employed to determine genetic diversity in the Saudi Arabian *faba bean* breeding program to our best knowledge.

Keywords: *Faba bean, Genetic Diversity, PCA, Multivariate Analysis*

NOVEL TOXIGENIC SPECIES ON MAIZE KERNELS IN SOUTHEASTERN EUROPE

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Abstract

In recent years, global climate changes have caused the variability of agro-climatic conditions, which could contribute to the synthesis of higher concentrations of mycotoxins in cereal grains during the growing season and could result in economic losses in the production, as well as in increased risk to human and animal health. These reasons and the fact that new toxigenic species have been identified in Serbia and its neighbouring countries in a few past years, indicate the need for permanent monitoring of mycopopulations on cereals. In Serbia, 30 different species of the genus *Aspergillus* have been identified, isolated mainly from cereal grains. The uncommonly high frequency and incidence of *Aspergillus* infestation of maize grain in the last few years were caused by extremely stressful agrometeorological conditions, high temperatures and drought over the period from flowering to waxy maturation of maize. Molecular detection of *Aspergillus* species collected from different samples of cereal kernels was done by using PCR-RFLP analysis of *aflR-aflJ* intergenic spacer (IGS). Restriction digestion of PCR products with *BglII* enzyme gave profiles specific for *A. parasiticus* - two fragments of 363 and 311 bp, which confirmed the presence of this species in the samples subjected to analysis. Characterization of Fg complex species was done by DNA sequence-based analysis using primer pairs ef1/ef2. Specific genome fragments were sequenced and analyzed. Sequences were compared to the data from GeneBank. Most of the tested isolates appeared to represent *F. graminearum sensu stricto* species, while only two of them were identified as *Fusarium boothii* and *Fusarium vorosii*.

Key words: *maize, Aspergillus, Fusarium.*

CONTAMINATION OF MAIZE KERNELS WITH MYCOTOXINS AFTER HARVEST

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Abstract

The species of the genus *Fusarium* and *Aspergillus* are the most common pathogens of maize kernels worldwide. The most common species among them are *F. verticillioides*, *F. graminearum* and *A. flavus*. These fungi produce a wide spectrum of mycotoxins, among which the most common are fusariotoxins: trichothecenes-deoxynivalenol (DON), fumonisins (FBs) and aflatoxins: aflatoxin B1 (AFB1). The aim of this study was to examine the mycopopulation on maize kernels after harvest, as well as the concentration of their mycotoxins in kernels. Standard mycological examinations of maize kernels revealed the presence of toxigenic species of fungi from three genus, *Fusarium*, *Aspergillus* and *Penicillium*. In the examined samples, the species *F. verticillioides* was most often isolated in majority of hybrids, with a maximum incidence of 32%, while the presence of *Aspergillus* spp. was from 0 to 17%. Mycotoxicological analysis of maize kernels was performed by the ELISA method using a commercial kit (Tecna S.r.l., Italy). All analysed samples were positive for the presence of at least one mycotoxin. The differences between the examined hybrids in the concentration of mycotoxins in the grain were statistically significant ($P < 0.001$) for DON and FBs, but not for the content of AFB1. Likewise, the interaction between hybrids and localities was statistically significant ($P < 0.001$) for DON and FBS content, while it was not statistically significant for AFB1 concentration. The average DON concentrations were $127,55 \mu\text{g kg}^{-1}$, FBs $3050,21 \mu\text{g kg}^{-1}$, and AFB1 $2,98 \mu\text{g kg}^{-1}$.

Key words: *maize, deoxynivalenol, fumonisin, aflatoxin B1.*

GENETIC POTENTIAL OF BREAD WHEAT UNDER ABIOTIC STRESS CONDITIONS

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Abstract

As the world population grows from year to year, so does the problem of creating enough food. Thus, there is a need for more arable land to grow crops that would be used for human consumption. Also, another challenge facing today's agricultural production is adapting to climate change and global warming. Five bread wheat (*Triticum aestivum* L.) genotypes were compared, from which there were four genotypes made at Institute of Field and Vegetable Crops in Novi Sad: Pobeda, Renesansa, Sara and Pesma, and one local population of bread wheat: Banatka. These varieties were grown on two locations in Vojvodina, Serbia: Rimski Šančevi on chernozem soil, and in Kumane, on solonetz, strongly alkaline, less productive type of soil. The results show variability between studied values of wheat yield components (spike length, spike weight, grain weight per spike and number of grains per spike) dependent on the genotype, as well as the location and genotype × environment interaction. The obtained results of this experiment indicate a different influence of stress conditions of wheat cultivation on halomorphic soil, where all genotypes, to different degrees, reacted negatively to stress. The local population Banatka stands out, having lower average values of the examined yield components, in favorable agroecological growing conditions, but in stress conditions it had competitive results with the results of other genotypes. This genotype can be used as a source of genetic material for breeding and obtaining genotypes that achieve stable yields in different environmental conditions.

Key words: *Wheat, Chernozem, Solonetz, Yield components, Variability.*

WEED CONTROL IN SUDAN GRASS CROP (*Sorghum sudanense*)

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Abstract

The paper analyzes the influence of different sowing densities and the application of herbicides with different mechanisms of action on the weediness of Sudan grass crops in subsequent sowing. At the same time, their influence on the forage yield and yield components of Sudan grass (Srem variety) was analyzed. The experiment was set up according to the split-plot system by sowing in two densities (12 and 25 cm row spacing). Three herbicide treatments were used: control - without herbicide application, Bentazone (herbicide Bentamark in the amount of 3 L ha⁻¹) and 2.4 D (herbicide Maton in the amount of 1 L ha⁻¹). The number of weeds in the mowing phase was on the variant with higher density by 72.5%, and on the variant with lower density by 46% less compared to the phase when the Sudanese grass was 20 cm high. The reduction of weediness is a consequence of the pronounced competitive relations of Sudanese grass in the later stages of growth and development. By analyzing the effectiveness of applied herbicides, it can be concluded that both active substances significantly reduced the number of weeds. Slightly higher efficiency was observed in the variant where the active substance 2.4 D was used. The general efficiency of herbicides was 89.9%. However, the best yield of green mass and hay of Sudan grass were achieved on the control variant without the application of herbicides.

Key words: *cultivation density, forage yield, herbicides, Sudan grass*

EARLY SELECTION OF WHEAT GENOTYPES USING ROOT AND SHOOT TRAITS AT SEEDLING STAGE

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Abstract

Screening genotypes at early growing stage is considered important to breeders and researchers in crop improvement. A set of 101 wheat genotypes 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 stage and to determine the relationship among shoot and root traits. Considerable phenotypic variation existed for seminal roots length, root angle (measured between the first pair of seminal roots) and branching depth of primary root. 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). The cluster analysis, based on observed traits, showed the homogeneity of genotypes originating from the region of the South-East Europe. A subset of 18 genotypes with different/exceptional root and shoot characteristic have been chosen as parents for 16 targeted crosses to produce novel germplasm in wheat for improving early vigour and tolerance to drought. The average hybrid vigour across all combinations and traits under osmotic stress was -2.3% and 8.5% in non-stress and osmotic stress conditions, respectively. No one crossing combination showed positive hybrid vigour for all traits.

Key words: *root, shoot, hydroponics, osmotic stress, hybrid vigour.*

VARIABILITY OF STEM HEIGHT IN WHEAT AND TRITICALE UNDER INFLUENCE OF APPLIED INSECTICIDES

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Abstract

Stem height have significant impact in forming of yield. The aim of this study was estimation of variability of stem height in wheat and triticale grown in different environmental conditions. The three wheat and three triticale varieties were included in field experiment in three vegetative seasons. The experiment was set up as a randomized block design in three replications. Insecticides Desis (deltamethrin) and Bifentrin (bifenthrin) were applied in phase of booting and before of heading in aim of protection from attack of *Oulema melanopus*. The results showed that wheat Belija had significantly higher stem height in each year (83.75 cm, 83.85 cm, 83.18 cm) than wheat varieties Aurelia (66.53 cm, 68.26 cm, 68.37 cm) and Zemunska Rosa (72.44 cm, 79.83 cm, 79.18 cm). The stem height was the highest in triticale Admiral (97.27 cm) in first year, while in Zenit was in second (111,15 cm), third years (105.58 cm) and in average for all three years (104,52 cm). The least stem height in first and third year had triticale Agrounija while in second and in average for all three years had Admiral. The application of insecticides deltamethrin caused depression of stem height in wheat from 1.0% (Aurelia) to 2.99% (Belija), while in triticale from 0.3% (Admiral) to 0.7% (Zenit). Bifentrin caused greater depression of stem height in wheat from 1.21% (Zemunska Rosa) to 3.78% (Belija) as well in triticale from 0,73% in Zenit to 1.20% in Agrounija, while it is increased stem height for 0.1% in Admiral. The results indicate that stem height varied and depended on genetic and environmental factor and from their interactions (G/E).

Key words: *wheat, triticale, stem height, varieties*

PHENOTYPIC VARIABILITY AND SIMILARITY OF NUMBER OF PRODUCTIVE TILLERS IN WHEAT VARIETIES (*TRITICUM AESTIVUM* L.)

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Abstract

Number of productive stem tillers influence on crop density, number of fertile spikes which is directly related to grain yield. Aim of this study is estimation variability of productive tillering of wheat varieties grown under different environmental condition. The 50 wheat varieties are included for investigation, during two years (2015-2017) in experiment which was set up as a randomized block design in three replications on the field in Kraljevo, Serbia. Sparse sowing was performed in order to enable the examined plants to fully manifest their traits. Sixty plants at the full maturity stage (20 replication⁻¹) were used for analysis of number of tillers. The analysis of variance was performed by MSTAT C (5.0 version).. Similarity among wheat was analyzed by hierarchical method of Euclidean distance. The results showed significant differences in number of tillers among varieties in both years, estimated by F-test. In average in the first year the smallest number of tillers 7.57 had Evropa 90 while the highest number of tillers (10.15) had Pobeda variety. In second year, the number of tillers varied from the lowest 8.42 in Evropa 90 to the highest 10.33 in Partizanka and Zastava. The similarity with Euclidean distance illustrated on dendrogram contained five clusters in first year and six cluster of varieties in second year. The prominent cluster contain different number and composition of varieties with the highest degree of similarity. The differences in average number of productive tillers were determined by genetic and environmental factor as well as by interaction genotype/environment.

Key words: *wheat, variety, tillers, similarity, environment*

VARIABILITY OF GLUTEN PROTEINS IN WHEAT (*TRITICUM AESTIVUM* L.)

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Abstract

Gluten proteins are formed from proteins of flour, gliadin and glutenins which in contact with water, begin to interact through the formation of chemical bonds. The aim of this study is identification of encoding genes polymorphisms of gliadin and glutenins in 10 bread wheat genotypes. For analysis used 30 seeds of 10 wheat genotypes for extraction of gliadins by 70% ethanol, and glutenins by 10% β -mercaptoethanol. The gliadins were separated by acid page electrophoresis (pH=3.1) on 8.33% polyacrylamide gel, while glutenins were separated by SDS-PAGE (pH=8.6) on 11.8% gel. Electrophoregrams were used for determining *Gli-1* and *Gli-2* alleles. The three alleles (*a*, *b*, *m*) at the *Gli-A1*, four alleles (*b*, *g*, *l*, *k*) at the *Gli-B1*, five alleles (*a*, *b*, *f*, *g*, *k*) at the *Gli-D1*, five alleles (*b*, *e*, *f*, *g*, *k*) at the *Gli-A2*, four alleles (*b*, *h*, *j*, *p*) at the *Gli-B2* and three alleles (*a*, *b*, *r*) at the *Gli-D2* locus were identified. For high molecular weight glutenin subunits (HMWGS) the three alleles (*a*, *b*, *c*) at the *Glu-A1*, three alleles (*b*, *c*, *d*) at the *Glu-B1* and two alleles (*a*, *d*) at the *Glu-D1* were identified. Gluten proteins varied according to composition alleles encoding gliadin and glutenins in analyzed wheat genotypes what related with established polymorphisms of each gliadin and glutenin loci.

Keywords: *wheat, gliadin, glutenin, allele, polymorphism quality.*

DRONE - SMART TECHNOLOGY ON SMALL AND MEDIUM FARMS

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Abstract

Drones (Unmanned Aerial Vehicles) in the recent past have been used primarily for military purposes, but lately they have been implemented in civil activity as well. With the development and modernization of agricultural production drone application has become more significant, so their usage in the sphere of agriculture is in second place, right after the military, according to the currently valid data. Unmanned Aerial Vehicles (UAV) in the last few years had great interest and commercial significance in world market and the potential of their development is for them to become an element of green technologies in the near future with a stress on sustainable and smart agriculture. Agricultural drones are equipped with dedicated equipment and software which provide a wide range of specific activities. Their possibilities are multi-faceted, such as analysis of micro relief, obtaining information on moisture, soil quality and fertility levels, based on which the crop sowing strategy is developed. They have wide application in chemical treatment of soil and plants, frost protection, irrigation scheduling, as well as management of fertilizer application considering spatial variability of crop growth and field conditions. They can be used to identify present weeds in the field, in order to opportunely eradicate them from the field and stop their competition for natural resources with the main cultivated crop. With the development of smart farming and progress of sensing, robotic, information and communication technologies, drones have great potential to improve agriculture. This paper shows the benefits and possibilities of drones usage on individual small and medium farms.

Keywords: *Drones technology, UAV, small and medium farms, crop help monitoring, pesticides.*

BENEFICIAL EFFECTS OF UV-A RADIATION ON MUNG BEAN (*VIGNA RADIATA* L.) SEEDS

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Abstract

Mung bean (*Vigna Radiata* L.) seeds are an important source of both nutrients (such as proteins, fibers, vitamins) and a variety of bioactive compounds (like phenolic compounds). Ultraviolet (UV) light has an important function as a major environmental signal important for plant growth and development, but at the same time it may cause certain damaging effects on macromolecules and other cellular components. Plants respond to the production of reactive oxygen species (ROS), caused by UV irradiation, by activating changes in morphology, physiology, or production of secondary metabolites. Some of these mechanisms increase antioxidant capacity in order to reduce the harmful effect of produced ROS. In the present research, the duration of exposure to UV-A irradiation and its influence on antioxidant activity of mung bean seeds were studied. Seeds were exposed to constant irradiation for 1 or 3 hours using a UV-A lamp ($93\mu\text{W}/\text{cm}^2$) at a 50 cm distance. Antioxidant activity was tested using DPPH (2,2-Diphenyl-1-picrylhydrazyl) assay. The results indicate a significant increase in antioxidant activity of the UV-A irradiated seeds after 1 hour ($74,45\% \pm 0,40$), compared to the control ($72,85\% \pm 1,55$). After prolonged exposure, measured antioxidant activity significantly increased ($77,99\% \pm 0,71$). Our results show a correlation between duration of UV-A irradiation and the increase in antioxidant activity. This could be beneficial in agriculture for producing fortified food.

Keywords: *Mung bean seeds, UV-A, antioxidant activity.*

NUTRITIONAL AND PRODUCTION PROPERTIES OF TRITICALE DEPENDING ON THE AMOUNT OF NITROGEN FERTILIZER

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Abstract

The great possibility of using triticale for different purposes, as well as the pronounced variety differences, impose the need for a more complete study of its varieties with the aim of their more efficient use in wide production. The aim of this paper is to present the results regarding the yield and protein content in grain obtained at four triticale varieties, studied during two years, under different levels of fertilization with nitrogen. In this regard, four triticale varieties were conducted in northern Montenegro to research the possible influences of nitrogen levels on grain yield and grain protein content. Nitrogen was used in the following quantities: N₀ (control), N₁ (60 kg ha⁻¹), N₂ (80 kg ha⁻¹), N₃ (150 kg ha⁻¹), where 1/3 of the planned amount was used together with sowing, and the rest of the planned amount in top dressing in the early spring. The results of the research showed the differences between varieties in response to a variation in N level. The highest performance of grain yield of four cultivars was associated with the highest amount of nitrogen (150 kg ha⁻¹). The cultivar Triumph achieved the highest grain yield in both years of testing. The lowest grain yield in the first year was in the varieties Kg-20 and Favorit, and in the variety Kg-20 in the second year. The lowest protein content in the grain was recorded in the variety Triumph.

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

ASSOCIATION OF AGRONOMIC AND FORAGE QUALITY TRAITS IN RED CLOVER (*TRIFOLIUM PRATENSE* L.)

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Abstract

Red clover (*Trifolium pratense* L.) is a source of highly nutritional voluminous forage for livestock feed. The objectives of this investigation were to: I) annotate associations of agronomic and forage quality traits of red clover accessions; II) group accessions in relation to analyzed traits. The plant material used included 46 cultivars and local populations, which originated from 17 countries, representing part of the red clover collection from the Institute of Field and Vegetable Crops in Novi Sad, Serbia. The field trial was sown during two growing seasons in Novi Sad. The agronomic traits (plant height-PH, internodes number *per* stem-IN, green mass yield-GMY, dry matter yield-DMY) were evaluated from the second cut in the nursery of the second year of life. Forage quality traits analyzed were content of neutral detergent fibers (NDF), acid detergent fiber (ADF), and crude protein (CP). In regard to very strong associations of PH, GMY and DMY, and to moderately strong associations of PH and IN, it could be anticipated that the indirect selection for higher plants with higher IN can lead to higher GMY and DMY. The breeding of red clover for NDF and ADF and elevated CP might be successful, but can reduce herbage yield (due to very weak positive and negative associations with GMY and DMY). The accessions were grouped to the six clusters which can facilitate selection and breeding for different agronomic and quality objectives.

Keywords: *Red clover, agronomic traits, forage quality, PCA biplot.*

INFLUENCE OF AQUEOUS EXTRACTS FROM BANANA PEEL AND SOYBEAN PLANTS ON SOYBEAN GRAIN YIELD

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Abstract

Foliar aqueous extract application has a positive effect on soybean yield and quality. The aim of this research was to examine the influence of foliar application of aqueous banana peel and apical soybean plant part extracts on the yield of five soybean varieties that are of different maturity groups. This way, plant material would be used for soybean grain yield increase, and synthetic artificial fertilizer use would be avoided along with environmental pollution. The results were processed via tri-factorial experiment variance analysis, and significance of differences was tested via LSD test. Foliar application of aqueous banana peel extract increased soybean yield in a three-year experiment by 4.07% (annually from 1.33% to 6.62%), and the application of aqueous apical soybean plant part extract by 4.21% (annually from 1.21% to 6.90%). Greater yield increase was recorded during years that were unfavorable for soybean production, with the varieties Rubin (5.69% and 5.90%) and Merkur (4.34% and 4.40%) having a greater yield increase compared to other soybean varieties included in the experiment (NS Kaća 3.73% and 3.30%, NS Maximus 3.37% and 3.76%, NS Apolo 3.04% and 3.38%). The year immensely influences soybean yield, primarily depending on precipitation distribution and quantity and temperature conditions during the vegetation period. Aqueous banana peel and apical soybean plant part extracts significantly increase soybean yield.

Key words: *aqueous extracts, foliar application, yield, varieties, soybeans*

ASSOCIATIONS OF AGRONOMIC AND FORAGE QUALITY TRAITS IN RED CLOVER (*TRIFOLIUM PRATENSE* L.)

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Abstract

Red clover (*Trifolium pratense* L.) is a source of highly nutritional voluminous forage for livestock feed. The objectives of this investigation were to: i) annotate associations of agronomic and forage quality traits of red clover accessions; ii) group accessions in relation to analysed traits. The plant material used included 46 cultivars and local populations, which originated from 17 countries, representing part of the red clover collection from the Institute of Field and Vegetable Crops in Novi Sad, Serbia. The field trial was sown during two growing seasons, as randomized complete block design with three replications, in Novi Sad. The agronomic traits (plant height-PH, internodes number *per* stem-IN, green mass yield-GMY, dry matter yield-DMY) were evaluated from the second cut in the nursery of the second year of life. Forage quality traits analysed were content of neutral detergent fibers (NDF), acid detergent fiber (ADF), and crude protein (CP). In regard to very strong associations of PH, GMY and DMY, and to moderately strong associations of PH and IN, it could be anticipated that the indirect selection for higher plants with higher IN can lead to higher GMY and DMY. The breeding of red clover for NDF and ADF and elevated CP might be successful, but can reduce herbage yield (due to very weak positive and negative associations with GMY and DMY). The accessions were grouped to the six clusters which can facilitate selection and breeding for different agronomic and quality objectives.

Keywords: *Red clover (Trifolium pratense L.), agronomic traits, forage quality, PCA (Principal Component Analysis) biplot*

CHARACTERISTICS OF EARLY-RIPENING BLACKBERRY CULTIVARS (*RUBUS FRUTICOSUS* L.)

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Abstract

The paper presents two-year results of investigation of the phenological, biological and production characteristics of early-ripening blackberry cultivars: Loch Ness, Black Satin and Čačanska Bestrna. The most cultivated blackberry cultivar in Serbia is Čačanska Bestrna. Agroecological conditions enable the successful cultivation of other cultivars whose purpose, apart from processing, can also be table consumption. According to the results, Loch Ness and Black Satin cultivars had an earlier beginning of the flowering phenophase in relation to Čačanska Bestrna. The earliest beginning of fruit ripening was achieved in the Loch Ness cultivar – on July 15. Two days later, the ripening of Black Satin fruits started, and two more days later, the Čačanska Bestrna fruits began to ripen. The length of the fruit ripening period in Čačanska Bestrna and Loch Ness was 25 days, while in the Black Satin cultivar it was shorter - 22 days. The largest fruit mass was in the cultivar Čačanska Bestrna - 7.82 g, the smaller was in the cultivar Loch Ness - 6.65 g, and the smallest in the cultivar Black Satin - 4.95 g. The content of total soluble solids ranged from 10.3 °Brix (Čačanska Bestrna) to 12.3 °Brix (Loch Ness). Čačanska Bestrna proved to be the cultivar with the highest yield - 22.75 t / ha, while the yield of the other two cultivars was significantly lower - 9.59 t/ha for Black Satin, and 8.35 t/ha for Loch Ness.

Keywords: *blackberry, fruit characteristics, yield, flowering, harvest.*

PROPERTIES OF NEW SERBIAN GENOTYPES OF EUROPEAN PLUM GROWN IN THE REGION OF ČAČAK (SERBIA)

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Abstract

‘Lana’ and ‘G’ are the latest genotypes of European plum that were developed in the Republic of Serbia. ‘Lana’ was obtained at Fruit Research Institute, Čačak from the cross ‘California Blue’ × ‘Ruth Gerstetter’ and named and released in 2020. Genotype ‘G’ is spontaneous seedling selected at Faculty of Agriculture in Novi Sad and was recognized at the beginning of 2022, but has not yet been named. In order to examine performance of those cultivars in agro-ecological conditions of Čačak, this study was done during three consecutive years (2016–2018). The most relevant biological characteristics (flowering and ripening time; morphometric, chemical and organoleptic properties of fruit) and field resistance to causal agents of economically important viral (*Plum pox virus*) and fungal (red leaf spot, rust and fruit rot) diseases were evaluated. ‘Čačanska Rana’ was used as a standard for ‘Lana’, while ‘Čačanska Lepotica’ was control cultivar for ‘G’. ‘Lana’ exhibited later flowering onset (one day) and ripening time (10 days), larger fruit and higher level of field resistance to causal agents of red leaf spot and rust than ‘Čačanska Rana’. The fruit organoleptic properties and field resistance to *Plum pox virus* of ‘Lana’ were in line with standard, though similar or lower values of investigated fruit chemical properties were observed. The flowering and ripening time of genotype ‘G’ occurred two and 10 days later than in ‘Čačanska Lepotica’. The morphometric and organoleptic fruit properties of genotype ‘G’ were similar to those of ‘Čačanska Lepotica’, although significantly higher values of the assessed fruit chemical properties were found. Also, genotype ‘G’ demonstrated the same level of field resistance to *Plum pox virus* as standard and better results regarding the field resistance to causal agents of fungal diseases.

Key words: *Plum, flowering and ripening time, fruit quality, field resistance.*

EXAMINATION OF SEED QUALITY PARAMETERS OF THREE PEPPER VARIETIES IN A FIVE-YEAR PERIOD (*CAPSICUM ANNUUM* L.)

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Abstract

Sweet pepper (*Capsicum annum* L.) is considered one of the most popular vegetables in the world. During five consecutive years (2017-2021) the most important indicators of seed quality (seed germination, energy, seed purity and moisture) and health safety were analyzed in three varieties of peppers (*Capsicum annum* L.): Palanačko čudo, Župska rana and Duga bela. During the research, very high values of all important parameters of seed quality were determined. The average determined seed purity was 98.6 % with a variation over the years of examination from 99.10% to 99.9%. Seed germination varied in the range of 73% to 94%, while the average germination was 86%. Germination energy was in the range of 61% to 88%. Seed moisture data showed that it was in the tolerance range of 6.3% to 7.4% per test year, with an average value of 6.9%. *Alternaria* spp and *Fusarium* spp were detected in minimal percent or no detection on variety of Palanačko čudo. Duga bela had the highest percentage of *Alternaria* spp. in 2020 and 2021, which were 2% and 3%, respectively. *Fusarium* spp. was presented in percentage more than in Župska rana and Palanačko čudo. The total germination of the Palanačko čudo, Župska rana and Duga bela during the observed five-year period was above the legal level of minimum and can be classified as quality seed.

Key words: *seed, energy, germination, moisture, purity.*

STATIC MAGNETIC FIELD IMPROVES EFFECTS OF BIOPRIMING BY *AZOTOBACTER CHROOCOCCUM* F8/2

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Abstract

Seed inoculation (biopriming) represents an agronomic practice directed towards improving germination, as well as fostering beneficial plant-microbe interaction from the very beginning of plants' life. Besides biopriming, static magnetic field (SMF) is studied as an abiotic factor affecting germination and plant growth. This paper is aimed to examine the combined effect of *Azotobacter chroococcum* F8/2 and SMF of 90 mT on germination. *A. chroococcum* F8/2 has been proven as a successful biopriming agent, with beneficial effect on cucumber, tomato, wheat, and soybean germination. This research starts from the hypothesis that the combined effect of *Azotobacter* inoculation and SMF could lead to synergistic improvement of germination parameters, compared to already shown effects of biopriming itself. The research was conducted with following cultivable plants: basil, cucumber, tomato, wheat, and soybean. Seed treatment was performed by 1h-immersion of surface-sterilized seeds into bacterial suspension (10^7 CFU/ml), followed by exposure to SMF of 90 mT for 5 min and 15 min. The germination test was conducted with 100 seeds per treatment and lasted 7 days. The highest improvement of germination percentages was observed in cucumber and basil (an increase for 35-41% and 41-45%, respectively), compared to biopriming without SMF treatment. Tomato and wheat germination were not improved by addition of SMF treatment to biopriming. The obtained results indicate that the application of SMF can affect the germination parameters that are changed by biopriming. There is a need for further research in order to explain the differences between plant species' response.

Keywords: *Azotobacter chroococcum*, biopriming, germination, static magnetic field.

NUTRITIONAL VALUE OF WILD BERRY SPECIES FROM MOUNTAIN KOPAONIK (SERBIA)

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Abstract

A large number of wild relatives of cultivated fruits in Serbia indicates a significant biological and primarily genetic diversity of wild berry species. Wild berry species are rich in phenols that are usually associated with health benefits due to their antioxidant capacity. The purpose of this work was to investigate the content of total anthocyanins and total phenols of wild berry species fruit extracts originating from an area of mountain Kopaonik (south Serbia): strawberry (*Fragaria vesca* L. and *Fragaria viridis* L.), raspberry (*Rubus idaeus* L. and *Rubus sahatilis* L.), blackberry (*Rubus fruticosus* L.), red currant (*Ribes petraeum* L.) and blueberry (*Vaccinium myrtillus* L.) as well as their antioxidant capacity. Blueberry and blackberry were characterized by the highest presence of anthocyanins (3.71 and 1.33 g C3G kg⁻¹ FW). The blueberry extract (*Vaccinium myrtillus* L.) was also the richest in the content of total phenols (4.94 g GAE kg⁻¹ FW) followed by an extract of strawberry (*Fragaria viridis* L.) and blackberry (*Rubus fruticosus* L.). The antioxidant effects of the sample extracts were evaluated through DPPH (2,2-diphenyl-1-picrylhydrazyl) antiradical assay which is shown that raspberry species *Rubus sahatilis* L. had significantly higher antioxidative activity (244.87 mM TE mL⁻¹) compared to other examined wild berry species. However, despite the very high content of anthocyanins and phenols, the antioxidant capacity of blueberry extract was the lowest (211.78 mM TE mL⁻¹). In conclusion, the present research increased the knowledge about the nutritive properties of Serbian wild berry species in order to support their conservation and use in the breeding programs of small fruits for choosing berry fruits with a high content of health-promoting properties.

Keywords: *Wild berries, Phenols, Anthocyanins, Antioxidative activity*

STRUCTURAL AND NON-STRUCTURAL CARBOHYDRATES CONTENT OF APPLE POMACE SILAGES

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Abstract

Apple pomace was ensiled without additives and with the addition of 15% dried beet pulp in order to increase the level of DM, 15% of sunflower meal and 15% dry beet pulp and 1% of NPN substances, and each of these treatments with and without inoculant. Apple pomace (AP) was obtained from the factory VINO Župa Aleksandrovac, delivered to the Institute of Forage Crops in Kruševac, location Globoder, on April 2nd 2013 and ensiling was performed on April 3rd 2013. Study treatments in the present research of the apple pomace silage were: added feed (A) and applied inoculant (B): A₁ - ensiled apple pomace 100% participation (a₁b₁ - apple pomace without inoculants; a₁b₂ - apple pomace with inoculants; A₂ - apple pomace 85% + 15% of dry beet pulp (a₂b₁ - without inoculants; a₂b₂ with inoculants); A₃ - apple pomace 85% + 15% sunflower meal (a₃b₁ - without inoculants and a₃b₂ with inoculants); A₄ - apple pomace 84% + 15% sugar beet pulp + Benural S 1% (a₄b₁ - without inoculants and a₄b₂ with inoculants). Results of these investigations showed that apple pomace silage with dry beet pulp had the highest CHO (817.8 g kg⁻¹ DM), NFC (358.7 g kg⁻¹ DM) and WSC (44.9 g kg⁻¹ DM) contents. This study has shown that apple pomace silages, as a by-product of the technological process has significant nutritional value.

Keywords: *apple pomace silage, dry beet pulp, sunflower meal.*

VARIABILITY AND HERITABILITY OF GRAIN YIELD AND HECTOLITER MASS IN WHEAT

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Abstract

In the two-year field experiment (2013/2014 and 2014/2015), the variability of yield and hectoliter grain mass of 14 winter wheat genotypes was examined. The research was conducted in three locations across the Republic of Serbia: Centre for Small Grains in Kragujevac, Institute for forage crops in Kruševac and Agroinstitute in Sombor. Significant differences in grain yield were found between varieties, locations, years and their interactions, while the influence of the location did not show significant differences in hectoliter mass. Grain yield of studied wheat genotypes in 2013/2014 varied from 3.91 t ha⁻¹ (KG-244/4) to 5.55 t ha⁻¹ (KG-60-3/3), and in 2014/2015 from 5.67 t ha⁻¹ (KG-162/7) to 7.08 t ha⁻¹ (KG-27/6). The hectoliter mass also varied, and most often ranged from 72.1 kg hl⁻¹ (KG-28/6) to 77.2 kg hl⁻¹ (KG-191/5-13) in the first experimental year and from 76.7 kg hl⁻¹ (KG-27/6) to 81.9 kg hl⁻¹ (KG-191/5-13) in the second year. Unfavorable weather conditions which prevailed in the first experimental year, conditioned the formation of smaller and shriveled grains. As a result, the examined KG-wheat genotypes gave lower values in grain yield and hectoliter mass in 2013/2014 compared to 2014/2015. In this study, higher values of heritability in a broad sense were obtained for hectoliter mass (73.66%), and lower values for grain yield (25.82%). This indicates that direct breeding for grain yield is less efficient and it is necessary to have knowledge about the nature of the inheritance of important yield components in order to improve this complex trait.

Keywords: *wheat, yield, hectoliter mass, variability, heritability.*

COMPARISON OF BIOCHEMICAL METHODS FOR β -CAROTENE EVALUATION OF MAIZE INBRED LINES IMPROVED THROUGH MARKER ASSISTED BREEDING

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Abstract

Marker assisted breeding program aimed at developing β -carotene (BC) rich maize for growing in temperate regions is being conducted at Maize Research Institute “Zemun Polje” (MRIZP). Molecular markers were used both for precise transfer of gene of interest (foreground selection) and the recovery of the recurrent parent’s genome (background selection). Thus, the *crtRBI* recessive homozygotes with the highest recovery of recurrent parent’s genome were identified and their progenies were screened for BC content to confirm their nutritional superiority. The results presented in this paper relate to biochemical analyses aimed to identify BC₂F₃ plants with increased BC in conversion of three MRIZP commercial inbred lines (RP₁-RP₃). Two methods were used to determine BC and results were compared. The average BC content obtained by HPLC ranged from 12.68 $\mu\text{g/g}$ in RP₃ to 18.39 $\mu\text{g/g}$ in RP₂. Similarly, spectrophotometry recorded BC from 12.81 $\mu\text{g/g}$ in RP₃ to 20.23 $\mu\text{g/g}$ in RP₂. Although few discrepancies between individual results derived from these methods, both methods were informative in our research. Spectrophotometry has proved to be simpler, faster and less expensive method that can be used to determine the increase in BC relative to the RP line. However, when more precise BC determination is required, HPLC is highly recommended. Out of 34 derivations from three lines, 24 were chosen for the highest increase in BC content. These lines will serve as an important breeding material for developing β -carotene rich maize hybrids adapted to temperate regions.

Key words: *maize, marker assisted selection, β -carotene, spectrophotometry, HPLC.*

PROPAGATION OF *ZELKOVA CARPINIFOLIA* (PALL.) DIPPEL. BY SOFTWOOD AND HEEL CUTTINGS

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Abstract

Zelkova carpinifolia (Caucasian elm, Caucasian zelkova) is highly valued ornamental tree, with unusually short and wide trunk and attractive leaves that turn golden orange in the autumn. Caucasian elm is native to Armenia, Georgia and Turkey, but it is not invasive in Europe and it is more resistant to Dutch elm disease than native elms. Caucasian zelkova can be propagated by seed or vegetatively by cuttings, but seed germination is low and vegetative propagation is the more suitable propagation method. There are reports regarding *Z. carpinifolia* propagation using a softwood cuttings with basal part containing a small section of the previous season wood (heel cuttings). The aim of this study was to evaluate possibility of using softwood cuttings with current season wood only (without heel). The cuttings were treated with 50 ppm IBA (Indole-3-butyric acid) solution for 24 h or with 2500 ppm IBA for 5 seconds (quick-dip method) and rooted under intermittent mist system. The highest rooting rate was obtained with softwood cuttings without heel treated with 2500 ppm IBA (50.5%), while rooting percentage of heel cuttings was lower (44%) after the same quick-dip treatment. However, rooting percentage of heel cuttings was higher (48%) after treatment with 50 ppm IBA compared to softwood cuttings without heel (33%). Control treatment for both types of cuttings resulted in very low germination rate indicating that auxine is necessary for propagation of Caucasian zelkova.

Keywords: *Caucasian zelkova, Caucasian elm, softwood cuttings, heel cuttings, quick-dip method.*

GERMINATION OF ZANTHOXYLUM ARMATUM DC. SEED UNDER DIFFERENT TREATMENTS

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Abstract

Zanthoxylum armatum (rattan pepper, winged prickly ash) is a deciduous, spiny shrub originating from Asia. It has wide environmental tolerance and it can be used as an ornamental plant, suitable for living fences. Besides, rattan pepper is also used in folk medicine, essential oil production and as spice. It can grow in zone six and it is successfully planted in Bulgaria, indicating that this species can be cultivated in Serbia as well. For this reason, the seeds from healthy and vigorous plants growing in the Arboretum of the University of Forestry (Sofia, Bulgaria) were collected considering that mother plants were well adapted to climatic conditions in Balkans. The seeds were brought into the Laboratory for Seed Testing in Faculty of Forestry, Belgrade. The cold stratification (3-month or 4-month) and concentrated (96%) sulfuric acid (H_2SO_4) pretreatments were used. The highest germination rate was recorded after 3 months of cold stratification (22%), and other treatments resulted in lower germination rates. Obtained results may be affected by a quality of seeds from selected seed source, but also by testing time because *Z. armatum* usually has a low germination and the high germination percentage was reported 150 days after placing seed on germination. In our research seed testing was conducted during 28 days. However, vegetative propagation should also be considered for this species.

Keywords: *winged prickly ash, rattan pepper, dormancy, stratification, sulfuric acid.*

GERMINATION OF TETRADIUM DANIELLII (BENN.) T. G. HARTLEY. SEED EXPOSED TO DIFFERENT TREATMENTS

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Abstract

Tetradium daniellii (syn. *Evodia hupehensis* Dode), bee-bee tree or Korean evodia is a fast growing deciduous tree, with fragrant flowers blooming during summer at a time when few other trees are in flower. This melliferous species is native to Korea and China, but it is not recorded as an invasive species in Europe. It can be propagated by seed or vegetatively by root cuttings. There is no available data regarding generative propagation of this species and expected germination rate. For this reason, the seed pods were collected from healthy, vigorous elite tree growing in Temerin, in November. The following treatments were used: cold stratification in sand (30 or 60 days), immersion of seeds in hot water at 90°C for 90 seconds, alternate freezing and thawing (24 h at -18°C, 24h at the room temperature). The highest germination rate was obtained after four alternate freezing and thawing treatments (27%). Lower germination of 19.5% was obtained after single freezing and thawing treatment, while cold stratification resulted in very low germination, not exceeding 5%. There were no germinated seeds after hot water treatment and only 2.7% seeds germinated in the control, suggesting that appropriate pretreatments are required for *T. daniellii* germination, but additional research should be conducted in order to improve germination rate.

Keywords: *bee-bee tree, Korean evodia, cold stratification, alternate freezing and thawing.*

EFFECTS OF RED AND FAR-RED LIGHT ON SEED GERMINATION OF CASUARINA CUNNINGHAMIANA MIQ.

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Abstract

Casuarina cunninghamiana is an ornamental medium or large tree originating from Australia but today it is widely cultivated worldwide, including European countries (Spain, Portugal, United Kingdom). It is fast-growing tree suitable for planting near rivers or lakes, growing even in saline soils, and it is used in erosion control or wind protection. The wood is used for panelling, furniture or as a fuelwood. *C. cunninghamiana* can be propagated by seed or vegetatively by cuttings, but generative propagation is the most commonly used for propagation of this species. The seeds are small and possibly photoblastic and the aim of this research was to determine the effects of red and far-red light on seed germination. The collected seeds imbibed for 72 hours, followed by exposure to red light (R), far-red light (FR), their combinations before placing seeds on germination. The seeds in the control treatment were kept in dark. Obtained results showed that River oak seeds are photoblastic, and the best germination rate (90.0%) was obtained after red light treatment, followed by germination in white light conditions (80.0%), and combination R-FR-R (87.8%). The germination in a control treatment was low (30.9%). However, germination energy was significantly higher in white light conditions (80.0%), than after red light treatment (11.1%).

Keywords: *River oak, germination, photoblastic seed, photosensitivity, far-red light.*

INFLUENCE OF THE COVID-19 PANDEMIC ON THE IMPORT AND EXPORT OF ROSES IN SERBIA

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Abstract

Roses are an important part of the flower production in Serbia. The rose cut flowers, grafted plants and rootstocks are produced for both domestic and international market. During the past three years, Covid-19 pandemic influenced production and consumption of roses worldwide, so the aim of this study was to determine how the pandemic influenced export and import of roses in Serbia. In order to obtain more accurate data, the roses trade in Serbia during pandemic years (2020 and 2021) was compared to the average data for five year period before the pandemic (2015-2019). The rose plants (both grafted and rootstocks) have considerably larger share in rose export compared to cut roses. Before the pandemic the average export of rose plants was 1104.72 metric tons with average value of 2.28M (USD). However, in 2021 the quantity of exported plants remained almost the same (1102.7 tons) but the value increased by 41.9% (3.23M). The export markets also changed. For example, Russia was the main importer of Serbian rose plants before the pandemic. However export to Russia decreased by 52.16% while export to EU rose by 244% in 2021. The export of cut roses also increased considerably during the pandemic by 648%, from an average 0.03M before pandemic to 0.2M in 2021. In Serbia, the pandemic did not have a negative impact on roses production and trade, and export increased considerably. However, international market may change again after the pandemic and it is important to work on improving roses production in Serbia and increasing the competitiveness on international markets.

Keywords: *cut roses production, roses trade, grafted roses market, roses rootstock plants.*

THE IMPACT OF THE COVID-19 PANDEMIC ON GREENERY TRADE IN SERBIA

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Abstract

Besides cut flowers, greenery (cut greens or cut foliage) also represents an important part of the floricultural industry. The Covid-19 pandemic crisis led to the worldwide reduction of the production due to workers absence from work or working reduced hours, resulting in the drop in consumption and income. For this reason, the aim of this study was to compare greenery trade in Serbia during a five-year period before the pandemic (2015-2019) with the period during the pandemic (2020 and 2021). The total quantity (tons) of exported greenery decreased by 23.2% in 2020 compared to five-year period before the pandemic. However, the total value (in USD) of exported greenery rose by 57.6%. The quantity of exported cut foliage continued to decrease in 2021 by 7.1% compared to 2020, and the value of exported greenery rose by 6.9%. The main export markets are the European Union (EU), Switzerland and the countries of the Central European Free Trade Agreement (CEFTA). Despite expectations, the quantity of imported greenery doubled in 2021 compared to 2015-2019 period, and the value of imports in 2021 increased by 276.4% in comparison with five-year period before the pandemic. The greenery was imported mainly from EU and Costa Rica. The obtained data indicate that there is a rising demand on cut foliage markets and that cut greenery production should be increased in Serbia. The main amount of greenery for export is wild harvested and there is room for expanding existing nursery production.

Keywords: *cut greens production, cut greens trade, cut foliage market.*

ATTITUDES OF LOCAL PEOPLE TOWARD *ALLIUM URSINUM* L. CONSERVATION

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Abstract

Bear garlic (*Allium ursinum* L.) is an edible and medicinal plant, widely used in Serbia, and it has been collected by local people for consumption and sale. Bear garlic is not an endangered plant in Serbia, but it is included in the Rulebook on the proclamation and protection of strictly protected and protected wild species of plants, animals and fungi, as an economically significant species that could be endangered by an uncontrolled exploitation or destruction of habitats. The aim of this study was to investigate attitude of villagers (potential producers) towards wild bear garlic conservation and potential production on their farms. The survey was conducted in the villages surrounding mountains Kosmaj, Avala and Suvobor, total 127 persons from 52 households were interviewed from May to September 2021. The majority of people interviewed (85.0%) use bear garlic only for consumption in their households. If the collection of bear garlic becomes restricted in their area according to the Decree on putting under control the use and trade of wild flora and fauna, 73.2% respondents would stop collecting, mainly because of high fines. However, 67.3% of households are ready to grow bear garlic if planting material and appropriate production technology are provided. Even 45.7% respondents do not care if bear garlic becomes an endangered species and 27.5% respondents do not trust official institutions dealing with the protection of biodiversity. Conducted research showed that technology for production of bear garlic should be established in order to reduce its gathering from natural habitats.

Keywords: *bear garlic, wild plants conservation, plant production.*

PERCEPTIONS OF URBAN PEOPLE TOWARD BEAR GARLIC GATHERING, ORGANIC AND CONVENTIONAL PRODUCTION

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Abstract

Allium ursinum L. (bear garlic) is often consumed as an edible and medicinal plant in Serbia. It is harvested in nature for consumption or sale in urban green markets. Although there are reports of production of bear garlic in some European countries, it is not cultivated yet in Serbia. The objective of this study was to investigate the willingness of people living in cities and not having the opportunity to collect bear garlic by themselves (consumers) to buy cultivated bear garlic instead of wild ones. The survey using semi-structured interviews was conducted in Belgrade in May 2021. The responses varied according to the age, education, and income of interviewees. Respondents (74.2%) prefer purchasing wild plants or organically produced ones because they believe that these plants have better medicinal and nutritional characteristics than plants produced by conventional ways. However, even 56.7% interviewees believe that plants marked as organically produced can be mislabeled and in fact produced by conventional ways. Only 22.5% of respondents would choose to buy cultivated bear garlic to help reduce its collection in natural habitats and those are mainly people 30-40 years old with higher education degrees. Obtained results showed that both conventional and organic technology for bear garlic production should be established for its cultivation in Serbian conditions. At the same time, it is necessary to raise the awareness of citizens about the importance of reducing the mass-collection of wild bear garlic and to strengthen trust in institutions that control the quality of organic production.

Keywords: *Allium ursinum*, organic production, conventional production, wild plants.

CONJUNCTIVE EFFECT OF ENVIRONMENT AND GENOTYPE IN MAIZE SEED PRODUCTION

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Abstract

Significant sources of normal plant development are the amount of available water, light, temperature and nutrients. This study aimed to examine to what extent the relationship between plant genetic structure and environmental conditions affects habitus and plant yield. In the two-year research, 2019 (Y1), and 2020 (Y2), with three maize lines (L1, L2, L3) produced at the Maize Research Institute, experiments were performed to assess the impact of genotype and environmental conditions on plant height to tassel (PHT), plant height to ear (PHE), ear weight (EW), cob weight (CW) and grain yield (GY). Seeds of different sizes were used in three sowings: large (S1), small (S2), and undivided (S3). The results of the PHE trial in the first year indicated a dominant genotype effect. L1 for all three sowings by seed size had the lowest cob position, S3G1 (69 cm), while L3 had the highest, (86.72 cm) for S3G1. In the second year of the study, environmental conditions and seed size significantly affected ($p \leq 0.05$) the PHE, as well as the PHT. The significance of the year effect was not confirmed by the weight of the cob. The highest yield was achieved for L1Y1S1 at 9.01 t ha^{-1} and the lowest for L1Y2S3 at 2.18 t ha^{-1} . Significant mutual effects of factors on the variability of traits are $Y \times L$, $Y \times S$, and $Y \times L \times S$. Differences in environmental conditions significantly affect the variability of maize corn seed properties. These effects can be reduced by proper genotype selection and the sowing of uniform size seeds.

Keywords: *environmental conditions, maize, cob position.*

PRODUCTION CHARACTERISTICS OF EGYPTIAN WALKING ONION (*Allium x proliferum*) GROWN IN THE ŠUMADIJA AND BRANIČEVO REGION

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Abstract

Egyptian Walking Onion (*Allium x proliferum*) is a perennial species, member of the *Alliaceae* family. In Serbia and broader region, it is grown only locally on small areas along the edges of the gardens, vineyards and orchards, because it does not form large and compact bulbs that have market value. On the other hand, the key advantage of Walking Egyptian Onion is greater tolerance to low temperatures and frost, i.e. early ripening of young onions. This allows producers to appear on the market earlier and consumers to have a quality product from the second half of winter until early spring. A multi-year study was conducted with the aim to determine the possibility of growing the Egyptian Walking Onion and its production and nutritional characteristics in the Šumadija and Braničevo Regions. On the four experimental locations (Žabari, Smederevska Palanka, Velika Plana and Jagodina) 15 samples from sole crops and intercrops with wines (*Vitis vinifera* L.) were collected for further investigation. The average values of plant height, number of leaves per plant, plant mass and antioxidative activity were measured, and ranged from 45.5 to 67.2 cm, 5.0 to 5.67, 57.75 to 77.5 g and 0.033 to 0.705 mg/g of fresh matter, respectively, depending of which part of plant was analyzed (green leaves or etiolated parts of leaves basis). Although, thanks to this preliminary research, significant data have been collected, it is necessary to continue further research, because it was not entirely possible to report clear conclusions.

Keywords: *intercropping, locations, onion, vineyard*

LEAF CHARACTERISTICS AND ANTIOXIDATIVE ACTIVITY OF COLLECTED AND CULTIVATED RAMSON (*Allium ursinum* L.) IN ŠUMADIJA REGION

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Abstract

Ramson or bear garlic (*Allium ursinum* L.) is a perennial species that is most often collected in its natural habitat. There is a possible threat of endangering it due to the increased demands on market, interests of the pharmaceutical industry, as well as devastation of natural habitat. This trial is conducted with aim to examine some traits of cultivated and collected samples of Ramson and in order to investigate the perspective of its assisted propagation and spreading. After finding several locations where Ramson is already present (in the area of the villages of Vodice and Stojačak near Smederevska Palanka and in the area of the villages of Gornji and Donji Račnik, near Jagodina) a procedure was taken to establish micro plantations on the four selected locations (green spaces, cultivated and uncultivated agricultural areas). During the late April, the samples of 10 leaves of Ramson for each of three replication were taken on the six different locations (five naturally inhabited and one with successfully propagated Ramson). Average mass of fresh leaves and leaf area were measured. Also, the antioxidative activity was performed (DPPH test). Depending on location the average leaf mass varied from 1.44 to 1.95 g, average leaf area ranged from 43.413 to 71.363 cm² and average antioxidative activity ranged from 0.077 to 0.291 mg/g of fresh weight. According to collected results, sustainable and successful propagation was achieved in only one location.

Keywords: *bear garlic, natural habitat, cultivation,*

ANALYSIS FOR GRAIN YIELD OF MAIZE HYBRIDS IN WESTERN SERBIA USING EBERHART AND RUSSELL MODEL

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Abstract

The main goal of breeding in the past period was mainly aimed at increasing the yield potential, but in the last 40 years, attention was paid to the stability of yields in different environmental conditions. The distribution of hybrids, ie its value depends not only on its yield potential, but also on the ability to maintain such a property at a high level in different environmental conditions: different years, location, crop density, cultivation method, fertilizer levels, sowing date, type of land, etc. An objective evaluation of maize hybrids in intensive cropping systems requires identification not only of yield components and other agronomically important traits, but also of stability parameters. This study aimed to analyze grain yield and thousand-kernel weight in 11 maize hybrids having different lengths of the growing season (FAO maturity groups 300–700) at three locations in the Republic of Serbia over a period of two years (2017–2018) using the Eberhart and Russell Model. There were significant differences between individual hybrids and localities in terms of grain yield and 1,000-kernel weight. Also, both analyzed traits showed a significant interaction with the environment. A comparative review of average yields and stability parameters showed that, regardless of the maturation group, hybrids with higher yields showed generally less favorable values of stability parameters, ie better adaptation to more favorable conditions and specific reaction. The latter hybrids had low yields and high yield stability compared to the other hybrids.

Keywords: *maize, hybrids, stability parameters, grain yield, 1,000-kernel weight.*

STABILITY PERFORMANCES OF DIFFERENT WHEAT GENOTYPES GROWN UNDER FAVORABLE AND SALINITY STRESS CONDITIONS

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Abstract

The present study was carried out to investigate the phenotypic variability and genotype \times environment interaction ($G \times E$) for spike weight of different wheat genotypes. The experiment included 27 wheat genotypes, grown under favorable conditions (Rimski Šančevi locality, Chernozem soil type) and salinity stress conditions (Kumane locality, Solonetz soil type), during two growing seasons. Using the AMMI analysis of variance we found a statistically significant ($p < 0.01$) influence of additive and non-additive sources of variation on the phenotypic variation of spike weight. Additive sources of variation (genotype and environment) had a share of 62.29% in the total sum of square. The environmental factors (growing season and soil type) contributed to the variation of spike weight with a share of 53.75% in the total variation of the experiment, while the factor of genotype had a significantly smaller share (8.54%). The $G \times E$ participated to the total variation of spike weight with 20.84%, where the first two principal interaction components (PCA_1 and PCA_2) explained 91.74% of the interaction. The genotypes Harmonija, KG-58, Orašanka, Renesansa, Morava, Perfekta and Bankut 1205 were characterized by high values of spike weight and high stability. Genotypes Bankut 1205, Banatka, Grbljanka and Morava were in positive interaction with the vector of environment Rimski Šančevi 2015/2016 (favorable conditions), while the genotypes Harmonija, Gružanka, Oplenka, Šumadija and Premija reacted well to salinity stress conditions of environment Kumane.

Key words: *AMMI analysis, Chernozem, $G \times E$, Solonetz, stability, wheat.*

POTENTIAL OF ESSENTIAL OILS AND HYDROLATES OF OCIMUM BASILICUM VAR. GENOVESE AND VAR. MINIMUM AS BACTERIOCIDE AGENT

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Abstract

The genus *Ocimum* has many species that are used to treat diverse kinds of illnesses and sicknesses from ancient times. One of them, *Ocimum basilicum*, has a vital role due to its various medicinal goods. It is commonly cultivated as a herbaceous, perennial plant, and is used as a culinary herb. It is best known as a plant with pharmacological activities to prevent cardiovascular disorders, diabetes, menstrual spasms, digestive disorders, and cancer. Additionally, it has been reported for antioxidant, antimicrobial, and larvicidal activities of this representative. Considering the above, the objective of this work was to evaluate the antimicrobial potential of essential oil and hydrolate of two different varieties: *Ocimum basilicum* var. *genovese* and *Ocimum basilicum* var. *minimum*. The preliminary screening of antimicrobial activity was performed by the disk diffusion method. According to the obtained preliminary results, it can be concluded that both tested oils showed high antimicrobial activity against *Escherichia coli* ATCC 25922, *Staphylococcus aureus* ATCC 25923, and *Salmonella Typhimurium* ATCC 13311. The tested hydrolates did not show any bactericide effect. In almost all cases of positive antimicrobial activity against the selected microorganisms, both essential oils expressed comparable results. Based on the gained results, the lowest minimal inhibitory concentration of 1.56% was noticed for both essential oils in the case of *Staphylococcus aureus*. On the other hand, this concentration for other sensitive microorganisms varies on the essential oil level. Following the obtained results, it can be pointed out that *Ocimum basilicum* var. *genovese* and var. *minimum* essential oils could be possibly used as a promising biocide agent or protection against the main foodborne pathogens.

Keywords: *essential oils, antibacterial activity, Ocimum basilicum*

YIELD COMPONENTS VARIABILITY AND INTERRELATIONSHIP OF EUROPEAN WHEAT CULTIVARS

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Abstract

This research was conducted on Rimski Šančevi at the Institute of Field and Vegetable Crops, Novi Sad, Serbia. Fifteen divergent wheat genotypes different in their morphological and physiological characteristics as well as to originate from different parts of the world were selected. For wheat breeding to be successful it is necessary to know the interrelationship of a large number of components which together affect the yield height and quality. Grain yield and its components (spike length, plant height, grain weight per spike, and heading time) were analyzed. For the data obtained from the experiment, the following parameters were calculated: mean, minimum, maximum value, coefficient of variation and standard deviation. Also, analysis of variance (ANOVA), correlation coefficient and Principal Component Analysis (PCA) were calculated. By applying the ANOVA model, it was found that among analyzed genotypes significant differences between tested traits were recorded. The coefficient of variation ranged from 5.02% to 30.85%. Correlation analysis showed that a strong positive relationship occurred between grain yield and grain mass per spike ($r = 0.815$), as well as between plant height and heading time ($r = 0.665$). A negative correlation occurred between heading time and yield ($r = -0.650$) and grain weight per spike and heading time ($r = -0.549$). Genotypes Apache, Pobeda and Acciaio achieved the highest results which were confirmed by Principal Component Analysis. By analyzing the obtained final results, it was concluded that between genotypes there was a variability that ranged widely for all tested traits.

Keywords: *wheat, yield, yield components, correlations, Principal Component Analysis.*

RESULTS OF TESTING THE QUALITY OF WORK OF DIFFERENT TYPES OF CROP SPRAYER NOZZLES

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Abstract

The quality of the work of the nozzles of the pesticide application machine is very important having in mind their function. In order to perform successfully, accurately, and efficiently protection of crops from biological agents, it is necessary that the sprinklers perform quality and uniform leakage of working fluid with a jet of appropriate shape, and droplet size with deposition on plant parts. According to ISO 10625, at an operating pressure of 2 bar, the nozzles must have a flow rate of 1.3 [l min⁻¹], and at an operating pressure of 3 bar a flow rate of 1.6 [l min⁻¹]. Bearing in mind the fact that rarely do sprayers achieve these flow values according to EN 13790 is a deviation of up to 5% for new sprayers in relation to the nominal capacities. The goal of our research was to determine the quality of work of different types of nozzles depending on the magnitude of the working pressure and the height of the nozzle. In the tests, the workflow determined liquids on several types of sprinklers, at an operating pressure of 2 and 3 bar. To test the flow AAMS-Salvarani measuring equipment was used in accordance with European standards according to EN 13790. The use of this measuring equipment provides the possibility for precision in determining the quality of work and irregularities in work. The obtained results indicate that it exists a significant influence of the value of working pressure and height on the quality of sprayer operation. Based on the obtained results, it was concluded that the lowest deviation of the working fluid flow of 1.35 was % measured at an operating pressure of 2 bar for type B nozzles, while the largest deviation from 34.61% was measured at a working pressure of 3 bar in type C sprinklers.

Keywords: *Nozzle, Flow, Quality of work, Working pressure, Distribution.*

IDENTIFICATION OF *ETRI* ALLELES IN SOME *MALUS* MILLER SPECIES

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Abstract

Wild *Malus* Miller species offer diversity essential for future breeding programmes that are not available within domestic and foreign apple cultivars. These species may provide novel alleles not just for disease resistance, but also for various desirable traits. Predicting and optimising the quality of stored apples and maximising their shelf life are becoming a major challenge worldwide. Ethylene regulates a broad spectrum of developmental and physiological processes in apple (including fruit ripening) and being perceived through the family of receptors, among which Ethylene Receptor 1 (ETR1) is one of the Subfamily I receptors, encoded by *ETRI* gene. This study aimed to identify the *ETRI* alleles in nine *Malus* Miller species from the *ex situ* collection of the Fruit Research Institute, Čačak, Republic of Serbia. The *ETRI* alleles were revealed by polymerase chain reaction (PCR) and additional restriction analysis of amplified PCR product (~5,000 bp) with *Rsa*I, *Alu*I and *Hinf*I enzymes. Upon comparison of the observed polymorphisms, six alleles of *ETRI* gene (*a*, *b*, *c*, *d*, *f* and *g*) were identified, among which *f* and *g* alleles were revealed in this study for the first time. Further characterisation of the novel alleles will be performed through cloning and sequencing of the corresponding DNA fragments. The polymorphisms observed upon PCR amplification and subsequent digestion with aforementioned restriction enzymes were generated in six allelic constitutions for *ETRI* gene – *bb* (one species), *bd* (one species), *bf* (one species), *b,a/c* (three species), *ff* (two species) and *g,a/c/d/g* (one species).

Keywords: *Apple, wild species, ethylene receptor, allelic constitution, fruit storage quality.*

THE RESPONSE OF DIFFERENT CULTIVARS BIRDSFOOT TREFOIL (*LOTUS CORNICULATUS L.*) ON PRE-SOWING INOCULATION

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Abstract

Birdsfoot trefoil (*Lotus corniculatus* L.) is a widespread plant species, which is important in providing sufficient quantities of quality fodder on soils of low production potential. Like many other forage legumes, this plant species has a well-developed symbiosis with rhizobia. The aim of this study was to evaluate the effect of pre-sowing inoculation on height and green mass of birdsfoot trefoil. The experiment was a two-factorial design, where the growth of plants influenced by three variants of microbial inoculation (individual cultures of *Rhizobium loti*, azotobacter (*Azotobacter chroococcum*) and actinomycetes (*Streptomyces* spp.)) was compared with the growth of noninoculated controls for three cultivars (K-37, Rocco and Bokor). For this study, plants were sown on acid soil with pH 4.91. Measurements were performed three times during two years of research: one cut in the first year and two cuts in the second year. For tested parameters, interaction between cultivar and inoculation resulted in a different effect compared to the control. Highest plant height was achieved in cv. Rocco: in the first year using actinomycetes and in two cuts of the second year using azotobacter. In this study minimum height was recorded in cv. Bokor. By using actinomycetes, the highest value for green mass was achieved in cv. K-37 in the first year and in the first cut of the second year. In this cultivar, using azotobacter the highest green mass in the second cut of the second year was achieved.

Keywords: *Birdsfoot trefoil, Green mass, Height, Microbial inoculation.*

FORAGE QUALITY OF DIFFERENT FESTULOLIUM CULTIVARS

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Abstract

Hybrids created by crossing between genera *Festuca* and *Lolium* species are *Festulolium*. Crossing species of these genera aim to combine their positive characteristics, such as *Festuca* tolerance to abiotic stresses and edaphic and climatic conditions with the high quality and digestibility of *Lolium perenne* and *Lolium multiflorum* species. Forage quality of 15 different Lolioid *Festulolium* cultivars and six cultivars of *Festuca* and *Lolium* pure species were investigated in a moderate continental climate in Kruševac, Serbia. Plots in the trial (7,5 m²) were completely randomized, each in three replications. In the year of establishment, the plots were cut without weighing and taking samples. In the next two years, two cuts were taken. The first cut was done at the beginning of the heading (the first half of May) and the second in the first half of July. On dry samples, from two cuts, the content of crude protein, crude cellulose, crude fat, ash, ADF, NDF and ADL was determined by standard laboratory methods. Results were presented as two-year average values. The best dry matter quality of *Festulolium* cultivars was determined for cultivars AberNiche and Felopa. The highest crude protein content in the first cut was determined for AberNiche (187.1 gkg⁻¹) and Felopa (169.6 gkg⁻¹). Also, the same cultivars noted the lowest values for ADF (296.7 and 303.5 gkg⁻¹) and for AberNiche was determined the lowest ADL content (35.4 gkg⁻¹) in the first cut. These cultivars are in the group of cultivars with the lowest NDF value. Based on the obtained results, it can be concluded that the analyzed *Festulolium* cultivars have a higher crude protein content compared to the cultivars of *Festuca* pure species, but lower than *Lolium* species.

Keywords: *Festuca*, *Lolium*, *Festulolium* cultivars, dry matter quality, crude protein content.

FERTILITY PARAMETERS AND GRAIN QUALITY OF WINTER BARLEY

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Abstract

The experiments were performed on samples of biomass and grains of winter barley varieties (Rekord and Zlatnik) for two years. The parameters of fertility and quality (yield, mass of 1000 grains and hectoliter mass, moisture, starch, lipids, ash, cellulose and β -glucan) were monitored. The average grain yield ranged from 3,933 t ha⁻¹ to 5,065 t ha⁻¹. Grain yield differed significantly between years and for all genotypes and on average was higher in the first year compared to the second year of cultivation. Average mass values of 1000 grains ranged from 41.60 to 54.83 g. It was found that there are very significant differences in grain yield compared to the year of testing, while the differences between the studied barley varieties were not significant. The results of the chemical composition of barley grains have shown that the tested parameters deviated between cultivars and years. The starch composition varied from 48.8% to 50.1%, while the composition of the crude protein varied from 10.5% to 11.3%. The average composition of the lipids per dry matter was 1.68% for cultivar Rekord and 1.77% for cultivar Zlatnik, respectively. In all tested samples, the composition of the crude cellulose varied from 3.27% to 3.82%. The obtained results showed that the lowest composition of the crude ashes was recorded in the sample of cultivar Rekord (1.58%), while the highest was detected in the sample of cultivar Zlatnik (1.70%). The composition of moisture ranged from 10.11% to 11.01%, while composition of β -glucan varied from 3.9% to 4.23%.

Key words: *barley, yield, fertility parameters, β -glucan, chemical composition.*

GENETIC DIVERSITY OF MAIZE INBREDS WITH DIFFERENT KERNEL TYPE USING SNP MARKERS

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Abstract

Analysis of genetic diversity and classification of different maize material has always been of great importance for planning maize breeding programs. In the last four decades, different molecular marker techniques have been developed and applied for these purposes. Rapid development of DNA sequencing techniques enabled discovery of molecular markers to high-throughput levels. As a result, specific SNP arrays are created which are suitable for genotyping. The aim of this study was genetic diversity analysis of 40 maize inbreds with different kernel type (sweet and popcorn maize) and different kernel color (yellow and white) using 25k SNP Illumina Infinum Array. Genetic distances were in a range from 0.07 to 0.46 with an average value of 0.40. These results reveal high genetic variability in a chosen set of maize inbreds. The average value of 0.31 for PIC indicate good informativeness of SNP markers. Observed heterozygosity ranged from 0 to 0.53. Cluster analysis performed in TASSEL software clearly separated specialty maize types (sweet and popcorn) from the genotypes with standard kernel type. Similar results showed PCA and analysis in STRUCTURE software. Results of this study provide the basis for further more profound analyses about genetic diversity and structure of the chosen material.

Keywords: *maize, SNPs, genetic diversity, inbreds, kernel type, kernel color.*

**PRELIMINARY RESULTS ON THE EFFECTS OF CONTROLLED-RELEASE
MINERAL AND CONVENTIONAL MINERAL FERTILIZERS ON GROWTH OF POT
GROWN *OCIMUM BASILICUM* L.**

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Abstract

In recent years, preference is given to use of controlled-release mineral fertilizers (CRMF) over conventional mineral fertilizers (CMF) in cultivating crops. CRMF have been designed to ensure delayed nutrient release, synchronized in time with the nutritional requirements of plants; whereas CMF are water-soluble fertilizers with relatively low nutrient assimilation by crops due immobilization and rinsing out of nutrients in soil. Therefore, this study aimed to determine whether an application of CRMF will result in the improvement in development of aboveground biomass of pot grown basil. The seedlings of basil were produced in laboratory conditions in containers placed inside a polyethylene tent (Grow Box), under the artificial lighting. With the development of the first true leaves, seedlings were transplanted into pots and submitted to treatments: CRMF- Osmocote (NPK 15:9:12 +2MgO+TE), CMF- (NPK 15:9:12, calculated and used doses of Urea N 46%, MAP NP 12:52, K₂SO₄ KS 52:18) and without adding fertilizer (control). After 60 days of growth in the non-heated greenhouse, for 30 plants of each treatment, the absolute dry mass of aboveground biomass (g/plant), number of branches and plant height (cm), were recorded. The highest yield of the aboveground biomass and the highest number of branches were obtained in CRMF (8.27± 1.65g and 5 to 7 branches/plant) compared to CMF (5.90±1.18 g and 3 to 6 branches/plant) and control (3.04±0.78g and 2 to 5 branches/plant), respectively. Regarding the plant height, the highest effect was equally achieved by CRMF (37.95± 3.71) and CMF (38.43± 5.18) compared to control (33.66± 2.41). Preliminary results have shown positive effects of CRMF on development of aboveground biomass of pot grown basil. Further analyzes should be conducted in terms of examining the impact of CRMF on basil raw material quality.

Keywords: *controlled-release fertilizer, mineral fertilizer, basil*

Acknowledgments: This study was supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia, Grant: 451-03-68/2022-14/200003.

USE OF CONTROLLED-RELEASE MINERAL FERTILIZER IN PRODUCTION OF POT GROWN *LEVISTICUM OFFICINALE* L.

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Abstract

Controlled-release mineral fertilizers (CRMF) have been developed and designed in order to improve the efficiency of fertilizers. Better efficiency in use of CRMF compared to conventional mineral fertilizers is mostly reflected in: decrease of chemical immobilization in soils which blocks uptake of nutrients by plants; lowering a fertilizer application frequency and rinsing out of nutrients in soil which consequently reduces a damaging effect on the environment. The aim of this study was to test if an application of CRMF will result in the improvement in development of aboveground biomass of pot grown lovage. The seedlings of lovage were produced in laboratory conditions, in containers placed inside a polyethylene tent (Grow Box), under the artificial lighting. With the development of the first true leaves, seedlings were transplanted into pots and submitted to treatments: CRMF- Osmocot Exact in formulation (NPK 15:9:12 +2MgO+TE), in which is gave 0,45 g N, 0,27 g P₂O₅ and 0,36 g K₂O per L of substrate (pot) and without adding fertilizer (control). After 60 days of growth in the non-heated greenhouse, for 30 plants of each treatment, the absolute dry mass of aboveground biomass (g/plant), number of branches and plant height (cm), were recorded. The highest yield of the aboveground biomass and the highest number of branches were obtained in CRMF (5.17± 0.72g and 6 to 13 branches/plant) compared to control (1.93±0.29g and 5 to 9 branches/plant), respectively. Regarding the plant height, better effect was achieved by CRMF (41.31± 3.43 cm) compared to control (29.37± 2.40 cm). Obtained results have shown positive effects of CRMF on development of aboveground biomass of pot grown lovage.

Keywords: *lovage, medicinal plant, controlled-release fertilizer*

SAFFLOWER (*CARTHAMUS TINCTORIUS* L.): GENETIC VARIABILITY OF PHENOTYPIC MARKERS OF YIELD

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Abstract

Safflower (*Carthamus tinctorius* L.) is an annual plant that has been used for centuries as an industrial and medicinal plant. Today, it is primarily grown for the production of oils that contain a high percentage of healthy fatty acids. This study presents the result with two divergent genotypes of safflower. The following characteristics were examined: plant height, the mass of 1000 seeds, hectolitre mass and seed yield. Phenotypic variability and interdependence of listed characteristics were observed by calculating a simple, Pearson, correlation coefficients and by analysis of the indirect correlation coefficients (Path analysis). A positive and highly significant interdependence was found between the seed yield and almost all of its examined components. Furthermore, the highest and highly significant value of correlation coefficient was established between the plant height and the seed yield ($r=0.90$). Based on the results of the path analysis, the plant height has the greatest direct influence (0.54), while the mass of 1000 seeds via the height of the plant has achieved the greatest indirect effect (0.42) on the seed yield. In addition to flax and camelina, safflower is suitable for breeding for specific environmental conditions, because it is tolerant of high concentrations of salt in the soil and drought.

Key words: *Safflower, Phenotypic variability, Simple correlation analysis, Path analysis, Yield.*

OPTIMIZATION OF THE PROTOCOL FOR *IN VITRO* PROPAGATION OF AUTOCHTHONOUS PLUM GENOTYPE 'METLAŠ'

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Abstract

Fast and cost-effective clonal propagation of planting material is possible to achieve by application of tissue culture *in vitro*. In this way, problems associated with traditional propagation, such as rapid spreading of diseases, lack of initial material caused by dependence on seasonal growth or low propagation coefficient can be overcome. This paper deals with optimization of micropropagation of autochthonous plum 'Metlaš' (*Prunus domestica* L.) originated from Guberevci (Municipality Knić, Serbia). 'Metlaš' is very often considered to be the same genotype as 'Okruglica' (syn. 'Dragačica'), but they can be clearly distinguished according to plant habit, stone and fruit characteristics. To optimize multiplication stage, the influence of benzyladenine (BA at 0.5, 1.0, 1.5 and 2.0 mg l⁻¹) and thidiazuron (TDZ at 0.25, 0.5, 1.0 and 1.5 mg l⁻¹) on the multiplication capacity (multiplication index, length of axial and lateral shoots) was examined. Rooting ability of shoots (rooting rate, number and length of roots, and height of rooted plants) was monitored on half strength Murashige and Skoog (MS) medium containing 1.0 mg l⁻¹ indole-3-butyric acid (IBA) or 1-naphthaleneacetic acid (NAA), each combined with 0.1 mg l⁻¹ gibberellic acid (GA₃). TDZ applied at 0.25 mg l⁻¹ gave the highest multiplication index (9.1), while the longest axial (14.1 mm) and axillary shoots (8.6 mm) were obtained on medium with 1.5 mg l⁻¹ BA. Although both auxins proved to be efficient in rhizogenesis (rooting rates being 85.7% and 95.2%), higher values of all rooting parameters were observed in the presence of IBA. Rooted shoots were successfully acclimatized.

Keywords: *Prunus domestica* L., *In vitro*, Multiplication, Rooting, Acclimatization.

MULTIVARIATE ANALYSIS OF AGRONOMIC TRAITS IN MID-SEASON SOYBEAN VARIETIES

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Abstract

Principal Component Analysis (PCA) is a useful tool for processing multiple data, which are often encountered in breeding practice. This method is suitable for the evaluation of genotypes on the basis of multiple traits and graphical presentation of relationships between traits. This study included 16 soybean mid-season genotypes (maturity group I), originated from different regions of the world, maintained in soybean collection of Maize Research Institute Zemun Polje. Field trials were carried out at two locations, during two years, according to a RCB design with three replications. The genotypes were evaluated in respect to eight major agronomic traits: *PH* – plant height, *NN* – node number, *PN* – pod number, *SN* – seed number, *TSW* – 1000 seed weight, *SYP* – seed yield per plant, *PROT* – protein content, *OIL* – oil content. First two PCA axes encompassed a large portion of the variance of standardized data (75,9%). Biplot distinguished genotypes of potential importance for various breeding targets. Two genotypes stood out with the largest 1000 seed weight. One variety formed a larger number of pods and the seed number per plant as compared to the group average, achieving the highest grain yield per plant. Two genotypes were among the most productive ones, with a larger number of pods as well as a higher 1000 seed weight, compared to the average. The most promising variety was Laura, which had a high yield and higher protein content than the average, and could be used as a potential germplasm source for the simultaneous improvement of both traits. Correlations among traits determined by PC biplot were in accordance with Pearson's correlation coefficients.

Keywords: *soybean, quantitative traits, multivariate analysis, correlations*

EVALUATION OF GRAIN FUNCTIONAL PROPERTIES AND ANTIOXIDANT ACTIVITY OF SOYBEAN VARIETIES AND EXPERIMENTAL LINES

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Abstract

Interest in functional soybean products has been rapidly increasing in recent years. The reason for that is the nutritional composition and properties with potentially beneficial effects on cardiovascular diseases and the overall health of consumers. In addition to being rich in protein, soybeans have a low content of saturated fats and do not contain cholesterol. Until now, the commercial soybean varieties released in Maize Research Institute and the superior inbred lines in the final stages of development have not been systematically and in detail characterized by the parameters of functional properties and technological grain quality. Five recognized cultivars of different maturity groups: Selena and Lela (group 0), Laura (group I), Lidija and Olga (group II), as well as experimental lines: yellow grain L 0161, L 12181, L 189, L 193, and brown grain L 121 were analyzed in this study. The highest content of total fiber (NDF), as well as high content of ADF, ADL (lignin), and hemicellulose, were found in the varieties Laura, Selena, and Lidija. Lower content of all fibers was observed in the experimental lines compared to soybean varieties. The highest content of total phenolic compounds was determined in the Laura variety (1354.18 µg GAE /g d.m.), while most of the total carotenoids were determined in line L 0161 (9.72 µg βCE/g d.m.). The highest total antioxidant capacity (39.65 mmol Trolox/kg d.m.) was determined in the brown grain line L 121 which can be attributed to the presence of higher content of phenolic compounds (anthocyanins, and proanthocyanidins) in colored grain genotypes. The content of phenolic acids such as vanillic, syringic, and sinapic acids in the investigated soybean genotypes also indicates the antioxidant functional properties of these legume grains.

Keywords: *soybean, functional properties, antioxidants*

EFFECTS OF BACTERIA AND ENZYME MIXTURE INOCULANTS ON QUALITY OF HIGH-MOISTURE MAIZE GRAIN SILAGE

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Abstract

The objective of this study was to evaluate the effect of applying lactic acid bacteria (LAB) and enzymes mixture inoculants (Sil-All and Silaprilis) on the chemical composition and fermentation of high-moisture grain silage of two maize hybrids Zenit and ZP 735. Maize hybrids were harvested at 68-72% of dry matter. Commercial inoculants were prepared and sprayed following the manufacturer's specifications. Silages were stored in glass jars with a special valve filled with water in the middle of the lid. Significant differences between hybrids were found for ash, crude protein, pH, and acetic acid. The hybrid Zenit had significantly higher ash (14.9 g kg⁻¹ dry matter (DM)), pH (4.03), and acetic acid (6.3 g kg⁻¹ DM), and significantly lower crude protein (89.0 g kg⁻¹ DM) than hybrid ZP 735 (12.5 g kg⁻¹ DM, 3.98, 5.1 g kg⁻¹ DM and 101.2 g kg⁻¹ DM, respectively). Compared to control, LAB+enzymes mixture inoculants stimulated ensiling of high-moisture maize grain. Inoculants decreased the contents of ammonia nitrogen and acetic acid, and pH value, and increased the contents of dry matter, ash, crude protein, crude fat, and lactic acid during silage fermentation than control. Accordingly, the application of LAB+enzymes mixture inoculants is justified and they can be recommended for high-quality silage production in feeding livestock.

Keywords: *grain maize silage, lactic acid bacteria+enzymes mixture inoculants, chemical composition, fermentation parameters.*

PRESERVATION AND PROTECTION OF OLD AUTOCHTHONOUS VARIETIES OF MELONS (*Cucumis melo L.*) AND WATERMELONS (*Citrullus lanatus L.*)

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Abstract

In 2007, the Agricultural Extension Service "Sombor", in cooperation with the Provincial Secretariat for Agriculture and the Ministry of Agriculture, launched the Pilot Project Let's Preserve and Protect Old Varieties of Vegetables. The goal of the project was to preserve old domestic varieties of vegetables traditionally grown in our area, and which survival was endangered with greater commercialization of vegetable production. In the study, 22 primary schools with 3163 participated. In this project 5296 samples were collected over three weeks. After collecting, the samples were each individually determined and sorted by plant species, marked, prepared for sowing and recorded in the sample database. Today, in 2022, over 1000 samples of old varieties and populations of vegetables and other plant species are being maintained within this program. During 2020 and 2021, in the experimental field of Agriculture Extension Service "Sombor", biological properties and production characteristics were evaluated from collected samples of watermelon and melon. This paper will present the phenotypic and morphological characteristics of interesting varieties of indigenous varieties of watermelon and. These varieties are excellent for further production and testing in laboratory conditions and also for organic production. With this project, forgotten plant species, varieties and food populations have been returned to production.

Keywords: *autochthonous, old variety, protection, melon, watermelon*

BOTANICAL COMPOSITION AND BIOMASS QUALITY IN NATURAL GRASSLANDS OF SOUTHEAST PART OF SERBIA

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Abstract

Grasslands are the most widespread ecosystem in the world, and they cover about 40% of the terrestrial areas. They are main food source for domestic and wild animal. The main role of grassland is to ensure a supply of livestock production as a source of healthy and safe animal food and that way they have strong contribution to rural economic development. Research was done in grassland from southeast part of Serbia. We research botanical composition and presented as percent of: grasses, legumes and forbs. All species were hand separated, were weighted and percent was calculated. Standard method was used for analyzing biomass quality. Results says that main number of samples were without legumes (24), while only in 5 samples recorded 30% legumes. Content of grasses was mainly high (more than 60%), while forbs abundance was satisfactory (till 30%). Analyzed grasslands, in these research, had an unsatisfactory quality of dry matter. Percent of biomass protein content was low and 47% analyzed samples showed less than 8% of the crude protein content. Botanical composition and quality biomass is mainly unsatisfactory, therefore agrotechnical mesurments and earlier cutting should be applied.

Keywords: *Grassland, botanical composition, quality biomass, legumes, grasses, protein content*

WEED INFESTATION OF WINTER WHEAT IN DIFFERENT TILLAGE SYSTEMS AND LEVEL OF NITROGEN IN TOP DRESSING

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Abstract

Growing technology, especially tillage and fertilization of economically important crop species such as wheat, plays a very important role in weed control. Successful weed control in the crop in turn significantly affects the formation of grain yield, both in quantity and quality. The aim of this paper was to investigate the influence of sustainable (mulch - and no- tillage) and conventional farming system on weed infestation of winter wheat. Basic fertilization was uniform (600 kg/ha NPK 15:15:15) while weed infestation differences between three levels of nitrogen fertilization in top dressing (0, 60 and 120 kg/ha) were examined. The variety Pobeda, selected at the Institute of Field and Vegetable Crops in Novi Sad, served as the object of investigation. The examination was performed at "Radmilovac" on the experimental school property of the Faculty of Agriculture in Zemun within the four- crop rotation (maize-winter wheat-spring barley + red clover-red clover) on leached chernozem soil type in a two-year period. The system of conventional tillage showed the highest efficiency in the weed control (number of weed species and number of weed plants per species) of the two conservation systems. The next is the system of mulch tillage, which may be of interest for practice, while the system of no tillage had the lowest efficiency in the control of weeds, especially perennials. Increasing the amount of nitrogen in the top dressing reduces weeds in all tillage systems, mainly due to the stronger competitiveness of winter wheat. The highest fresh biomass of weeds was measured in the no-tillage system (especially in the second year of investigation) due to the significantly higher presence of perennial broadleaf weeds.

Key words: *farming system, fertilization, nitrogen, control of weeds.*

EVALUATION OF PLANT SPACING AND MULCHING ON THE BELL PEPPER (*Capsicum annuum* L.) CHARACTERISTICS

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Abstract

The present study was carried out to evaluate the effect of plant spacing and mulching with polyethylene (PE) films on productivity value of bell pepper (*Capsicum annuum* L.). A two factor field experiment was conducted during 2019 growing season, at the Agricultural Experiment Station in Ljubljana, Slovenia. The treatment comprises of three plant spacing (16 500, 11 000 and 8 200 plants/ha) and three different mulches: black film, transparent film and bare soil replicated three times and arranged in randomized complete block design using bell pepper cv. Soroksari. The collected data were recorded on various variables and subjected to statistical analysis. Vegetative growth characteristics analysis suggested that the plant height, lateral stem number, leaf size and leaf number were increased as the plant spacing decreased. On the other hand, no significant differences due to mulching treatments were observed on the parameters listed above, except for plant height. Marketable yield (t/ha) was significantly highest at closest plant density and in black PE film. These results suggest that black PE film in combination with 8 200 plants/ha can be recommended for commercial planting of bell pepper seedling of cv. Soroksari under central Slovenia growing conditions.

Keywords: *Bell pepper, Characteristics, Polyethylene films, Plant spacing.*

SEED SIZE AND ALLOMETRIC RELATIONSHIPS AMONG LOCAL MAIZE VARIETIES IN GALICIA (NW SPAIN)

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Abstract

The AGRIECO research project promotes organic farming with local varieties of maize (*Zea mays* L.). Conservation of agrobiodiversity is important because local varieties show different traits that are valuable for adaptation to climate change. Seed size is a relevant trait for germination and seedling growth, fundamental processes for successful crop production. We analyse the differences among 20 maize local varieties from Galicia (NW Spain), from a seed bank (Phytogenetic Resources Center, CRF-CSIC-INIA) and from local farmers. Multivariate characterization of grain samples from these varieties showed relatively high phenotypic variability in average grain size and other physical traits. A measure of seed size, Thousand Kernel Weight (TKW) showed a range of 2.4 times among varieties, from 203 to 497 g, with statistically significant differences between some of them. In addition, TKW showed a 2-fold variation range in the coefficients of variation (CV) among varieties. The average and CV of TKW showed a relatively high negative intervarietal correlation. In addition, intervarietal and intravarietal allometric relationships between grain weight and volume were identified. The results demonstrate evidence of phenotypic differences in reproductive attributes among maize local varieties. They underline the feasibility and importance of a characterization of the components of biodiversity in order to promote their value and agricultural use.

Keywords: *agrobiodiversity, allometry, grain size, Galicia, sustainability.*

DIRECT ORGANOGENESIS OF *CATUNAREGAM SPINOSA* THROUGH NODAL AND INTERNODAL EXPLANTS

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Abstract

Catunaregam spinosa is a medicinal plant used for various therapeutic diseases. It is an exotic plant in Sri Lanka. Micropropagation is a productive plant generation method compared to conventional methods. Micropropagation of *C. spinosa* was studied using explants taken from nodes and internodes. Best surface sterilization protocol was standardized using different concentrations of Clorox[®] (7.5 % NaOCl) and Carbendazim[®] exposing to different time intervals. Organogenesis was tested with different concentrations (1.0 mg L⁻¹ – 4.0 mg L⁻¹) of 6-Benzylaminopurine (BAP) and 1-Naphthaleneacetic acid (NAA). Completely randomized design was used with 10 replicates per treatment. Leaf number, shoot length and percentage explants producing shoots were evaluated after four months of incubation. Data were statistically analyzed using ANOVA at significant level of $p = 0.05$. Best surface sterilization protocol found to be exposure to 0.2 % (w/v) Carbendazim for 10 mins, 10 % Clorox for 8 min. following two successive washings in sterile distilled water. Type of explant significantly affected the regeneration frequency and shoot growth. No plantlets were produced by both explants in media added with BAP and NAA in ratio of 1:1 and 2:2. Nodes recorded 100% regeneration except in media including 2.0 mgL⁻¹ BAP with NAA (2 or 3 mgL⁻¹) and BAP alone. Nodes recorded highest mean number of leaves (11.2± 1.03) and shoot length (4.66 ±0.25 cm) in MS medium supplemented with 3.0 mg L⁻¹ BAP and 1.0 mg L⁻¹ NAA. Internodes required higher concentration of BAP (4.0 mg L⁻¹) in producing highest mean number of leaves (7.6± 0.84) and shoot length (3.57± 0.18 cm). Internodes produced calli rather plantlets in ratios of (1:1), (1:2), (1:4), (3:4), (4:4) and BAP or NAA alone. Results of the present study revealed that nodal explants found to be better in direct organogenesis of *C. spinosa*.

Key words: *Catunaregam spinosa*, micropropagation, sterilization, nodes, internodes

ACCURACY DETECTION OF INTEL® REALSENSE D455 DEPTH CAMERA FOR AGRICULTURAL APPLICATIONS

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Abstract

Depth cameras are very important for automation applications in agriculture, especially in robotics and drone applications. But they are still developing, new sensor systems and additions are being tried by the manufacturers and end-users. Because of this reason, this article focuses on the Intel® RealSense D455 Depth Camera. To summarize, the calculation of depth from the stereo is explained in the article. Stereo depth cameras are made up of two fixed cameras that point in the same direction but are separated by a predetermined distance known as the baseline. Additionally, the measurement and management software is important for getting good results with firmware updates on the depth cameras. Intel® uses its own depth camera management software kit which contains a group of software called RealSense™ 2.0 Software Development Kit. It also supports different programming languages with some examples in it. The Intel® RealSense™ D400 series depth cameras are mainly used on drones, robots, homes, and surveillance, as well as virtual reality, and finally on PC peripherals. Because of this reason, an appropriate experiment was carried out to assess the feasibility of using one of these devices, for robots and drones, for agricultural applications. The primary conclusion of this paper is that Intel® RealSense Depth camera D455 produces a significantly higher-quality depth image than the cameras in D400 series depth cameras, with more discernible objects and obstacles.

Keywords: *Intel® realsense, Depth camera, Depth measurement, Device performance, Agricultural applications.*

EFFECTS OF DROUGHT STRESS ON PURSLANE (*PORTULACA OLERACEA*)

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Abstract

Purslane (*Portulaca oleracea* L.) is a herbaceous fleshy plant, which is relatively more drought tolerant than other species. Drought is one of the most important environmental stresses that influence the metabolism and growth of plants. The objective of this study was to determine the influence of drought stress on the chemical composition, yield and some quality parameters of purslane (*Portulaca oleracea*). The experiment was conducted in an unheated and 110 m² plastic polyethylene (PE) covered greenhouse of the Ege University- Bayındır Vocational Training School (38 ° 12 '09.9 " N, 27 ° 40' 20.8 " E) in Türkiye during the summer of 2021. The results showed that purslane yield was affected by the treatments, the highest (888 g pot⁻¹) being in the Control (I₁). Findings also indicated that the yield obtained from I_{0,8} irrigation dose was high and statistically in the same group with the Control. However, under water stress conditions (I_{0,6} and I_{0,4}), the yield decreased drastically as 607 and 537g pot⁻¹ respectively. The drought conditions/treatments in this respect had significant effects on yield, plant height, total plant number, thin stem plant number, and thick stem plant number. Chemical analysis (dry matter basis) of leaves showed insignificant differences among the different drought treatments for all the characteristics measured. Only leaf and stem K contents decreased as the water stress increased.

Key words: *Drought, purslane, yield, stress, plant nutrition.*

EFFECTS OF HEAT AND BAGGING APPLICATIONS ON EARLY-RIPENING AND FRUIT QUALITY CHARACTERISTICS OF SOME NEW APRICOT CULTIVARS UNDER PROTECTED CULTIVATION

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Abstract

This study was carried out to determine the effects of heat and fruit bagging applications on early-ripening, fruit set, fruit yield, and quality characteristics of 'Mikado' and 'Mogador' apricot cultivars grown under protected cultivation, in the eastern Mediterranean region of Turkey. Air cooling to apricot trees was applied between 18.00 pm and 07.00 am in December and January when the temperature was 10°C and the temperature was kept between 6.5°C and 7.2°C for the chilling requirements in the 2021-2022 season. In addition, the fruit of the cultivars was bagged for the fruit quality attributes about 30 days after the fruit set. The first blossoming in the 'Mikado' cultivar occurred on February 22, while the first bloom in the 'Mogador' cultivar occurred on February 25 under protected cultivation. The earliest fruit ripening was detected in the 'Mogador' cultivar (April 16). 'Mogador' also had the highest fruit weight (61.00 g). The yield per tree of 'Mogador' cultivar (4.31 kg/tree) was highest compared to 'Mikado' cultivar (3.84 kg/tree). The fruit bagging application mainly did not have a significant effect on the fruit quality of the cultivars. As a result, the controlled cooling application has positive effects especially on earliness in apricot cultivars, but it is necessary to continue working on the cooling application in a longer period for sufficient yield.

Keywords: *Apricot, cooling application, bagging, protected cultivation*

EFFECTS OF GIBBERELIC ACID (GA₃) APPLICATION ON SEED EMERGENCE OF F1 HYBRID FIGS

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Abstract

A high seed emergence rate of F1 hybrid individuals obtained after hybridization in fruit species is a desirable feature. This study was carried out to determine the effect of gibberellic acid on the germination of F1 seeds obtained from ‘Bursa Siyahı’ × Osmaniye02 crossing. In the study, 1000 ppm, 2000 ppm, and 3000 ppm GA₃ applications were applied to hybrid seeds to fresh seeds obtained after fruit harvest. The emergence rate, time to 50% (ET₅₀) of emergence, and mean emergence time (MET) were measured. The application of GA₃ increased the emergence of F1 hybrid seeds. The highest emergence rate was determined in the 2000 ppm GA₃ application (98.33%), whereas the emergence rate was 7.78% in the control. In addition, the T₅₀ and MET of the F1 hybrid seeds were the shortest in GA₃ applications compared to control. As a result, GA₃ applications to fresh F1 hybrid seeds obtained immediately after fruit harvest was successful application because they increased the emergence rate and shortened the emergence time.

Keywords: *Ficus carica*, *F1 hybrid seed*, *gibberellic acid*, *seed emergence*

DETERMINATION OF AGRONOMIC CHARACTERISTICS AND CARVACROL RATES OF B CLONES OF IMPROVED ISTANBUL OREGANO (*ORIGANUM VULGARE* SUBSP. *HIRTUM*)

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Abstract

The popularity of the *Origanum* genus increases due to proven beneficial effects, including antioxidants, antimicrobials and antifungals effects. There are many agronomical and breeding studies about improved new varieties and cultivation techniques of oregano have been increasing last few decades. *Origanum vulgare* subsp. *hirtum*, which is commonly found in Turkey flora, has been standing out with high essential oil content compared with other *Origanum* species. In this study, the results of the year 2020 field trial of B clones of the breeding study initiated to improve varieties with clone selection method in Istanbul oregano are presented. In the study, plant height (cm), fresh herb yield (g/plot), drug herb yield (g/plot), drug leaves yield (g/plot), leaf/stem ratio (%), essential oil ratio (%) and essential oil yield (g/plot) of 100 genotypes of B clones belonging to the five populations of Istanbul oregano grown in Aydın ecological conditions were investigated. In the study 20 genotypes were examined in each population, drug leaves yields for the populations of A, B, C, D and E were 22.2-139.9, 34.7-658.6, 44.4-221.2, 49.2-287.5 and 62-175.2 g/plot, respectively. The essential oil contents of the A, B, C, D and E populations also ranged between 2.8-6.35, 2.95-6.25, 3.1-5.3, 3.5-5.8 and 4.0-5.80%, respectively. Among the examined genotypes, it was determined that the most important component of the essential oil was carvacrol and the ratio varied between 53.60-82.34%. As a result, all clones were compared in terms of agronomic traits and carvacrol ratios and promising genotypes were selected to generate C clones.

Keywords: *Origanum vulgare* subsp. *hirtum*, clone selection, yield, essential oil, carvacrol.

DETERMINATION OF DRY MATTER YIELD AND SOME FORAGE QUALITY PARAMETERS OF SWITCH GRASS (*PANICUM VIRGATUM*) AS AFFECTED BY CUTTING HEIGHTS

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Abstract

Switch grass (*Panicum virgatum*) is a vigorous warm season, native perennial grass planted for many purposes including forage, wildlife cover, and as a biofuel crop. Because of the adequate nutrients, such as a high crude protein (CP) content and quality of fibers, switch grass are widely used as forage. Cutting height -i.e. the stubble heights above soil surface, is an important consideration in the management of perennial forage production systems, as it has a crucial effect on regrowth rate, yield, quality, and persistence of forage crops. This paper aims to investigate the relationship between yield and yield contributing characters of switch grass regarding the cutting height. A pot-experiment was conducted in Turkey under typical Mediterranean climate environment to evaluate the effect of five different cutting heights (0-, 5-, 10-, 15- and 20- cm) on forage yield, and nutritional values of switch grass. The switch grass genotype “Cloud nine” was used as plant material and plant height, number of tiller, dry matter (DM) yield; CP yield and contents of CP, NDF and ADF were measured in the study. Results indicated that cutting heights significantly affected yield and nutritional value of switch grass. The effect of deeper cuts tended to reduce digestibility of cell wall compounds. Total CP yield was significantly higher at 10- cm cutting height than the others were. Stubble heights of 5- to 10- cm can be recommended throughout the growing season for forage production of switch grass with acceptable DM yield and forage quality, and for the safe operation of the harvest equipment.

Keywords: *Switch grass, cutting height, yield, quality.*

RESPONSE OF GIANT KING GRASS (*PENNISETUM HYBRIDUM*) TO CUTTING HEIGHTS AND NITROGEN LEVELS GROWN FOR FORAGE

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Abstract

Giant king grass (*Pennisetum hybridum*) as a field crop is a perennial forage grass (physiologically C4), native to Africa, with a high growth rate, high productivity and good nutritive value and it is mostly used for -cut and carry- system over the tropical and sub-tropical areas of the world. Forage crops differ considerably in terms of their ability to recover from defoliation, which is strongly influenced by management practices, particularly the height of cutting. The use of modern commercial nitrogen (N) fertilizers in agricultural production results in increased crop yields in addition to the effect of better plant nutrition through nitrogen fertilizers signify themselves not only in increasing yields, but also in an increase in the total biomass production. This study was conducted to determine the effects of different cutting height and nitrogen levels on the forage yield and some quality parameters of giant king grass. The experiment was carried out at Ege University, Faculty of Agriculture, Department of Field Crops, Izmir/Turkey, during the summer growth seasons of 2019 and 2020. Five different cutting heights (0-, 5-, 10-, 15- and 20- cm) and five nitrogen levels (0, 50, 100, 150 and 200 kg N ha⁻¹) were tested on giant king grass. Some characteristics were measured such dry matter yield (DM), crude protein (CP) concentration, NDF and ADF contents. Cutting heights of 10- to 15- cm and application of 150 kg N ha⁻¹ can be recommended throughout the growing season for silage production of giant king grass for plant persistence, with high yield and acceptable forage quality, and for the safe operation of the harvest equipment's.

Keywords: *Giant king grass, cutting height, N level, yield, quality.*

A NEW CULTIVAR OF WALNUT (*JUGLANS REGIA* L.) “KAŞKA”

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Abstract

This study aimed to determine the phenological and pomological traits of new walnut cultivar named “Kaşka”. This is walnut cultivar that reaches a early harvest maturity and has some superior fruit traits. In 2022, the cultivar was registered and patented by the Variety Registration and Seed Certification Center of the Republic of Türkiye Ministry of Agriculture and Forestry. To determine the pomological and phenological traits of the “Kaşka”, 27 different traits were examined. The pomological analysis determined that the in-shell nut weight of “Kaşka” was 14-16 g and the kernel ratio was 54-57%. The shell and kernel of the cultivar were determined to be light in color and the surface of the shell to have a smooth structure. “Kaşka” had superior traits compared to the “Chandler” cultivar in terms of some of the pomological parameters such as in-shell nut weight, kernel weight, and kernel percentage. The new cultivar was seen to reach leafing, harvest maturity, and defoliation at an earlier date than “Chandler”. The dichogamy status of the cultivar was determined to be protandrous and in this respect, a pollinator cultivar was recommended for the establishment of orchards with “Kaşka”. The "Kaşka" variety, which has superior vegetative and pomological characteristics, can be easily grown in all areas suitable for walnut cultivation. It is also a very important genetic resource for future studies.

Dear Prof. Dr. Nurettin Kaşka passed away in 2022. In order to commemorate and thank our esteemed teacher with gratitude, the walnut variety that was the subject of the study was named "KAŞKA".

Key words: *Walnut, new cultivar, leafing, breeding, Phenology, Pomology*

DETERMINATION OF THE DIFFERENCES IN BIOACTIVE COMPOUNDS OF PUMPKIN FROM THE SEED TO THE PEEL

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Abstract

This study was performed to determine the total phenolic content, total flavonoid content, total tannin content, antioxidant activity by DPPH and phenolic compounds by HPLC of pumpkin seed, pulp and peel. The peel of pumpkin contained the highest amounts of total phenolic (97.22 mg/100 g) and total flavonoid (114.76 mg/100 g). The pumpkin peel (1.93 mmol/kg) exhibited better antioxidant activity. The lowest antioxidant activity (1.05 mmol/kg) was observed in the seed, while the pulp of sample had the minimum total flavonoid content (29.05 mg/100 g). To total phenolic content and total tannin amount of the pulp and the seed, the values were closed to each other, and there was no significant difference. There was a decrease in the total phenolic content and antioxidant activity of pumpkin when progressed from the peel to the seed. The main phenolic compounds of pumpkin parts were gallic acid (12.05-28.67 mg/100 g), 3,4-dihydroxybenzoic acid (11.78-22.91 mg/100 g), catechin (19.16-29.67 mg/100 g) and rutin (4.03-10.16 mg/100 g). The highest amounts of these phenolic compounds were detected in the peel of pumpkin. The lowest phenolic acid contents (such as gallic acid, 3,4-dihydroxybenzoic acid, caffeic acid and syringic acid) were observed in the seed of pumpkin. The pulp of pumpkin had the minimum flavonoid amounts (such as catechin and rutin). In addition, pumpkin contained *p*-coumaric acid, ferulic acid, quercetin, cinnamic acid and kaempferol in small amounts in all parts. With respect to phenolic compounds, there were no significant changes between the peel, pulp and seed of pumpkin ($p > 0.05$).

Keywords: *Bioactive properties, phenolic compounds, pumpkin, HPLC*

DETERMINATION OF AGRONOMIC CHARACTERISTICS AND CARVACROL RATES OF B CLONES OF IMPROVED ISTANBUL OREGANO (*ORIGANUM VULGARE* SUBSP. *HIRTUM*)

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Abstract

The popularity of the genus *Origanum* increases due to its many scientifically proven effects, including antioxidants, antimicrobials and antifungals. Agronomic and breeding studies on developing new varieties and cultivation techniques of oregano have been growing intention last few decades. *Origanum vulgare* subsp. *hirtum*, which is commonly found in Turkey flora, has been standing out with its high essential oil content compared to other *Origanum* species. In this study, the results of the year 2020 field trial of B clones of the breeding study initiated to develop varieties with clone selection method in Istanbul oregano are presented. In the study, plant height (cm), green herbage yield (g/plot), drug herbage yield (g/plot), drug leaf yield (g/plot), leaf/stem ratio (%), essential oil ratio (%) and essential oil yield (g/plot) of 100 genotypes of B clones belonging to the five populations of Istanbul oregano grown in Aydın ecological conditions were investigated. In the study in which 20 genotypes were investigated in each population, drug leaf yields for the populations of A, B, C, D and E were 22.2-139.9, 34.7-658.6, 44.4-221.2, 49.2-287.5 and 62-175.2 g/plot, respectively. Essential oil contents of the A, B, C, D and E populations also ranged among 2.8-6.35, 2.95-6.25, 3.1-5.3, 3.5-5.8 and 4.0-5.80%, respectively. Among the genotypes examined, it was determined that the most important component of the essential oil was carvacrol and the ratio varied between 53.60-82.34%. As a result, all clones were compared in terms of agronomic traits and carvacrol ratios and promising genotypes were selected to generate C clones.

Keywords: *Origanum vulgare* subsp. *hirtum*, clone selection, yield, essential oil, carvacrol.

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APPLICATION TECHNIQUES PESTICIDE IN IRAQ

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Abstract

Although the Iraqi economy is mainly based on oil, the fertile lands with the Tigris and Euphrates rivers and irrigation facilities make the agricultural sector important. Only half of the country 8 million hectares of agricultural land can be cultivated. Agriculture is the second main sector in the country, where wheat, barley, rice, apples and dates are grown as the main products. In addition to the climatic and geographical conditions in Iraq, the lack of technical knowledge and experience in the use of agricultural tools and machinery limits agricultural activities. Insufficient agricultural mechanization practices are also known among the reasons for the low yield values in Iraq. In terms of its potential agriculture is seen as an important sector open to development in every field in the country. Especially, studies aimed at increasing efficiency are increasing their importance day by day. Among these research areas, plant protection machines come to the fore. Field and fruit garden sprayers are generally used in fields and fruit gardens in Iraq. However, due to their low cost, knapsack sprayers are preferred intensively especially in fruit and vegetable gardens. In order to increase the yield in agricultural products, researches are carried out to determine pesticide losses in different nozzle types in sprayers. It is seen that there is a great deal of interest in research on the determination of application height spray pressure, volume median diameter in knapsack sprayers used in fruit and vegetable gardens. According to the results of the research conducted in Iraq, it was concluded that detailed and comprehensive studies were needed to determine the applicability of new techniques developed in the field of pesticide application in the world.

Keywords: *Iraq, pesticide applications, sprayer, knapsack sprayer, drift.*

EFFECT OF DEFICIT IRRIGATION ON ANTIOXIDANT, ANTIRADICAL AND FLAVONOID CONTENTS OF *Origanum vulgare* subsp. *hirtum* GENOTYPES

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Abstract

Istanbul oregano (*Origanum vulgare* subsp. *hirtum*) is one of the important medicinal plants naturally grown in Turkey. It is a valuable antioxidant plant from the Lamiaceae (Labiatae) family and native to the Mediterranean climate. Nowadays, plants belonging to the *Origanum* genus have attracted many attentions of consumers as a spice plant due to their high antifungal, antimicrobial and antioxidant properties. The extracts of Istanbul oregano have one of the most effective antioxidant activities among aromatic herbs. Plants exposed to insufficient water conditions have their photosynthesis decreased, growth and development negatively affected. This is an important factor that causes yield losses up to 50% in plants exposed to deficit water conditions. According to the World Resources Institute (WRI) 2020 data, there will be serious water shortages in Turkey along with other countries. Tolerant plants have more potential for higher levels of both osmolytes and antioxidants and reprogram their metabolism to enhance their antioxidant capacity in insufficient water conditions. In this study, the effects of three different deficit irrigation conditions (100%, 67% and 33%) on antioxidant (FRAP), antiradical (DPPH) and flavonoid properties of 12 different Istanbul oregano genotypes were investigated in 2020 and 2021. According to results, FRAP (Ferric Reducing Antioxidant Power), DPPH (2,2-diphenyl-1-picrylhydrazyl) and flavonoid values in 2020 were determined between 47.8-84.6%, 24.6-57.2%, 77,1-165.5 mg Rutin/g and values in 2021 were determined between 51.0-69.9%, 45.1-75.9%, and 105.8-182.4 mg Rutin/g respectively. The highest values were obtained at 33% irrigation condition for all properties.

Keywords: *Deficit irrigation, Genotype, Antioxidant capacity, Medicinal plant, Origanum vulgare subsp. hirtum.*

STATUS OF HAZELNUT BLENDING MECHANIZATION IN SAMSUN PROVINCE

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Abstract

Production should be increased by 70% in order to meet the food need that will arise as a result of the world population approaching approximately 9.7 billion in 2050. In order to meet the food needs of the increasing population, technological innovations in agricultural production should be introduced. It is known that agricultural mechanization applications can provide quality and efficiency in production, depending on the production in a way that will meet the expectations during the manufacturing stages. As in every field, mechanization has made great progress in the agricultural field, especially in recent years. For this purpose, it is extremely important to identify the problems in the manufacturing sector of the agricultural equipment in question and to propose solutions. The necessity of research on mechanization practices in strategic products that are cultivated regionally should not be ignored. Turkey produces approximately 70% of the world hazelnut production with an average of 500-600 thousand tons. However, in return for this, mechanization applications are extremely limited, especially during the harvest period. Harvest mechanization, which constitutes approximately 50% of the total cost in hazelnut, does not meet the expectations with the machines used in current applications. In the light of the developments in the post-harvest mechanization practices in hazelnut researches on this subject in our country are still up-to-date. The production of the equipment needed for hazelnut farming, which is of strategic importance for our country, remains up-to-date among the important issues that await solutions, along with its problems. The problems and solution proposals of the manufacturing sector in hazelnut threshing machines in Samsun province, where hazelnut farming is carried out intensively, are also evaluated within the scope of this study.

Keywords: *Hazelnut, hazelnut threshing machine, agricultural mechanization.*

PRO-VITAMIN A ENRICHMENT IN MAIZE THROUGH MARKER ASSISTED RECURRENT SELECTION

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Abstract

Maize is the most important cereal produced globally and an inexpensive and easily available source of food for millions of people in sub-Saharan Africa. However, most of the maize varieties produced in sub-Saharan Africa have quit low content of micronutrients such as pro-vitamin A (PVA). Consequently, people who are largely dependent on maize for their diets suffer from health challenges due to vitamin A deficiencies. Thus, biofortification through breeding is an effective and sustainable method to improve PVA content in maize. Marker assisted recurrent selection (MARS) which increases the frequency of favorable alleles with selection cycle has been used to enhance the PVA content of maize. This study was carried out to determine genetic gain in PVA content of a synthetic maize population with three cycles (C0, C1 and C2) developed through MARS. Representative samples from each cycle were planted at International Institute of Tropical Agriculture for phenotypic evaluation. At harvest, representative samples of kernels were analyzed for different carotenoids using High Performance Liquid Chromatography (HPLC). Genotyping was done from sixty plants randomly selected from each cycle with six crtRB1 KASP specific PVA markers to evaluate the improvement in PVA across cycles. Selection increased the concentrations of β -carotene, PVA and total carotenoids across cycles. The HPLC analysis indicated that the content of β -carotene, PVA, and total carotenoids increased by 40%, 30% and 36%, respectively, after two cycles of MARS. Out of the six crtRB1 KASP specific PVA markers used, the frequency of favorable alleles of four PVA markers improved after two cycles of selection. In general, MARS has effectively improved the PVA content in a synthetic maize.

Keywords: *genetic gain, biofortification, pro-vitamin A, micronutrient, and malnutrition*

EFFICIENCY OF CORN HYBRIDS GROWING TECHNOLOGIES DEPENDING ON THE KINDS OF FERTILIZER APPLICATION

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Abstract

Substantiation of efficiency of corn cultivation technologies using different types and methods of fertilizer application are presented in the paper. Field research was established in the field crop rotation of FE "Bogatyriivske" Romensky District of Sumy Region, Ukraine during 2019-2021 on dark gray podzolic soil. Statistical data processing was performed using the software package SAS 9.4. Hybrids are quite flexible to growing conditions and respond positively to nutrition optimization. The yield changes on average for 2019–2021 from 6.07 to 8.50 t/ha. Application of N₂₂P₅₇K₅₇ (active substance) in the form of diamophos provided a yield increase by 0.99 - 1.01 t/ha or 16.4%, and the application of nitrogen fertilizers against this background provided an additional yield increase by 0.57 - 1.33 t/ha or 7.95 - 18.6%. With the introduction of KAC 32, the yield increase of the hybrid EC Concord amounted to 2.19 t/ha or 36.1%; hybrid EC Asteroid 2.44 t/ha or 38.0% compared to the control version. The reaction of hybrids to the application of ammonia water and urea, which was found due to increased yields, was lower compared to the application of KAC 32. The profitability of corn grain production is extremely high – 44 - 80%. In combination of Humilin Stimul with all types of fertilizers, the highest effect was obtained with a single extra-feeding in the microstage BBCH 15-17. The energy efficiency coefficient for fertilizer application is reduced to 4.81 - 5.49, depending on the forms of fertilizers.

Keywords: *thermal units, yield, yield index.*

THE PHYSIOLOGICAL AND BIOCHEMICAL ESTIMATION OF THE ADAPTIVE ABILITY OF SUGAR BEET (*BETA VULGARIS* L.) TO SHADING AND PLANT DENSITY

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Abstract

The study of adaptive resistance to adverse environmental effects, which is connected with mechanisms of ontogenetic adaptation investigation, is an important direction of crop breeding. The adaptive resistance is identified on the phenotype level within the information stored and expressed by the genome. Ukrainian and Swedish lines, hybrids, and hybrid parent components of sugar beet under different shading conditions (30 and 60% of natural light) were investigated. Genotype-specific general physiological and biochemical features of the adaptive changes in leaves and productivity components in the course of metabolism are revealed. A significant decrease in the photosynthesis intensity and photochemical activity of chloroplasts occurred during the sugar beet plant adaptation to shading. The adaptive level of different sugar beet genotypes to low light was also expressed through the significant changes in the water-soluble carbohydrate pool of leaves themselves and leaf petioles. An important physiological parameter of sugar beet adaptive reaction is a response to shading in specific leaf weight (SLW), which is used in plant breeding as the trait of increased photosynthesis intensity. As a result of the study, it was found that the shading impacted significantly on the distribution and ratio of sucrose in the ring zones of vascular bundles and adjacent zones of the root storage parenchyma. The ontogenetic adaptation to photosynthetic active radiation light regime of photosynthetically active radiation (PAR) of sugar beet lines, hybrids, and their parent components of different origins under shading and different plant density in the field was shown. It was found that the stress intensity is a key characteristic of changes in physiological, biochemical, anatomical, and morphological traits of the leaf, which maintain plant homeostasis and ensure maximum efficiency of photosynthesis and productivity of different sugar beet genotypes under these conditions.

Keywords: *ontogenetic adaptation, sugar beet, physiological and biochemical features, adaptation.*

CROP PRODUCTION: FOOD SECURITY AND SOLUTIONS IN UKRAINE

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Abstract

Identifying the most important factors that make it possible to produce more food in the world and ensuring their efficient and rational use is crucial. Changes in the structure of plant use (food, feed, bioenergy) are exacerbating the problem of food security in the world. Nowadays, in order to solve food security problems, it is necessary to preserve and restore plant biodiversity. Climate change is causing the increasing use of plants with C4 type photosynthesis. Protection of natural ecosystems will ensure the biodiversity conservation. Stabilization of crop production, land use efficiency and innovative technologies for growing crops are interdependent. Field research was conducted in LLC "Biotech LTD", which is located in the central part of Boryspil district, Kyiv region. The farm is located in the Left Bank Forest-Steppe of Ukraine. The field experiment was conducted on dark gray podzolic soil. Growing sorghum hybrids in line with the principles of adaptive crop production must be carried out in accordance with the requirements of sustainable development of agriculture and environmental protection. The latest forms of fertilizers, the use of which involves the targeted use of nutrients, prolonged action of fertilizers underlie the plant nutrition system. The latest technologies for growing crops require an increase in energy consumption and resources per unit of output, leads to a growing impact on the environment, which requires a constant balanced assessment of technologies for energy efficiency.

Keywords: *food security, climate change, grain sorghum.*

EFFICIENCY OF CORN HYBRIDS GROWING TECHNOLOGIES DEPENDING ON THE KINDS OF FERTILIZER APPLICATION

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Abstract

Substantiation of efficiency of corn cultivation technologies using different types and methods of fertilizer application are presented in the paper. Field research was established in the field crop rotation of FE "Bogatyrivske" Romensky District of Sumy Region, Ukraine during 2019-2021 on dark gray podzolic soil. Statistical data processing was performed using the software package SAS 9.4. Hybrids are quite flexible to growing conditions and respond positively to nutrition optimization. The yield changes on average for 2019–2021 from 6.07 to 8.50 t/ha. Application of $N_{22}P_{57}K_{57}$ (active substance) in the form of diamophos provided a yield increase by 0.99 - 1.01 t/ha or 16.4%, and the application of nitrogen fertilizers against this background provided an additional yield increase by 0.57 - 1.33 t/ha or 7.95 - 18.6%. With the introduction of KAC 32, the yield increase of the hybrid EC Concord amounted to 2.19 t/ha or 36.1%; hybrid EC Asteroid 2.44 t/ha or 38.0% compared to the control version. The reaction of hybrids to the application of ammonia water and urea, which was found due to increased yields, was lower compared to the application of KAC 32. The profitability of corn grain production is extremely high – 44 - 80%. In combination of Humilin Stimul with all types of fertilizers, the highest effect was obtained with a single extra-feeding in the microstage BBCH 15-17. The energy efficiency coefficient for fertilizer application is reduced to 4.81 - 5.49, depending on the forms of fertilizers.

Keywords: *yield, types of fertilizers, efficiency of technology.*

HEAT AND PEG RESPONSIVE MICRORNAS IN ROOTS AND SHOOTS OF SORGHUM SEEDLINGS

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Abstract

Abiotic stresses, especially heat and drought are the primary causes of crop production decline world-wide. Sorghum is one of the tolerant plant species for both drought and heat. MicroRNAs fine-tune target gene expression at the posttranscriptional level by degrading and/or inhibiting the protein production and this regulation is critical for all most all biological processes in a plant species including adaptation to abiotic stresses. To gain an insight into microRNA networks that control drought and heat tolerance in Sorghum seedlings, we generated small RNA libraries from the roots and shoots of treated and untreated samples. Sequence analysis revealed identification of 197 known miRNAs belonging to 69 miRNA families. Interestingly, sbi-miR5564c-5p, sbi-miR159a_5p, sbi-miR156abcghi_5p, and sbi-miR5564ad_5p were the most abundant miRNAs detected in all of the twelve small RNA libraries. The comparative analysis between leaf and root revealed distinct spatial expression patterns of certain miRNAs during stress. During the heat and drought stress, nine miRNAs were found to be upregulated and three miRNAs were found to be upregulated and downregulated, respectively in both shoot and root tissues. These and other distinct differences will be presented.

Keywords: crop production, stress.

PLANT PROTECTION AND FOOD SAFETY

SEARCH FOR PESTICIDES IN SOME TOMATO CONCENTRATES PRODUCED AND MARKETED IN ALGERIA

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Abstract

The use of pesticides in agriculture remains our predominant days for the protection crop. This use makes it possible to fight effectively and quickly against the different pest agents. However, unavoidable effects are observed on the plant, the environment and the consumers by the presence of toxic substances. In this context, we researched pesticides residues in the main brands of tomato concentrates produced and marketed in Algeria. The results of chromatographic analysis revealed the presence of 16 to 30 peaks representing a foreign substances of tomato fruit, but close to substance used in the formulation of pesticides and a phyto sanitary products used in agriculture namely pyrimidine carboxylate and bipyridine. The analysis of pesticides residues come in support to many activities such a research in protection of the plant, the environmental monitoring and the protection of consumers. In this flame we engaged this work with for objective the quality control by the study of some physico-chemical parameters on the hand and the others pesticides residues. The chromatographic analysis shows the presence of 16 to 30 peaks gathering some toxic substances in trace state, can represented pesticides residues such as pyrimidine carboxylate and bipyridine, and others substances naturally presents in tomato fruit.

Key words: *Pesticides, Tomato concentrates, Pyrimidine, Chromatographic analysis, Agriculture.*

ESSENTIAL OIL OF ANISE SEEDS (*PIMPINELLA ANISUM*) BIO-PROTECTIVE EFFECT ON YOGHURT SHELF LIFE

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Abstract

The antioxidant and antibacterial activities of the essential oil extracted from *Pimpinella anisum* and the impact of its incorporation on the quality and shelf life of yoghurt were assessed in this study. The essential oil extracted by the hydrodistillation presented a yield of 2.54±0.04%. The antibacterial activity of EO was tested on 7 strains (*Escherichia coli*, *Klebsiella oxytoca*, *Bacillus cereus*, *Pseudomonas aeruginosa*, *Streptococcus mutans*, *Proteus vulgaris*, *Staphylococcus aureus*), only *Pseudomonas aeruginosa*, *Streptococcus mutans* were able to resist the antimicrobial activity of the essential oil. The enrichment of the yoghurt by PAEO, did not affect the physico-chemical properties of yoghurt and decrease the rate of the syneresis with the increase of the concentration of EO incorporated in the yogurt. The textural properties of the yoghurt were not affected by the incorporation of PAEO, while the taste and aroma were slightly modified with the appearance of a slight bitterness and astringent taste for high level of incorporated EO. The incorporation of EO in the yogurt improves yoghurt shelf life, reduces significantly the load of contaminating flora (coliforms) during storage and did not effect on the load of lactic acid bacteria.

Key words: *Essential oil, Pimpinella anisum, antioxidant activity, antibacterial activity, yoghurt, shelf life*

POSTHARVEST CONTROL OF *BOTRYTIS CINEREA* USING BACTERIAL VOLATILE ORGANIC COMPOUNDS

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Abstract

Botrytis cinerea is one of the most important postharvest fungal pathogens causing significant losses in fresh fruits, vegetables and ornamentals. Synthetic fungicides are primarily used to control postharvest decay loss, but due to their hazardous use the recent trend is shifting toward safer and more eco-friendly alternatives. The use of antagonistic microorganisms is becoming popular throughout the world. This study investigated the antifungal, the plant growth promoting activities and the identity of volatile organic compounds (VOCs) produced by tomato-derived endophytic bacteria strains. The capacity of selected strains to prevent postharvest *B. cinerea* infection on tomato fruit through VOCs and soluble compounds was also studied. A collection of 50 bacterial strains was established from different organs of tomato plants sampled from six localities in Cape Bon region (Tunisia). Despite the small geographical scale, complexity and abundance of endophytic communities varied greatly according to the site of origin. Healthy tomato plants harbor diverse endophytic bacteria of *Bacillus* and *Enterobacter* genera colonizing mainly leaves with a significant enrichment with *Bacillus* strains. The *in vitro* dual culture assays showed that 36 % of the endophytic bacterial strains produce antifungal VOCs against *B. cinerea*. To our knowledge, this is the first report of VOCs antifungal activity produced by *B. nakamurai*, *B. pseudomycooides*, *B. proteolyticus*, *B. thuringiensis*, *E. asburiae* and *E. cloacae* against *B. cinerea*. About 14 % of bacterial strains produce VOCs with *in vitro* specific promoting effects on tomato seedling length or biomass production. The five selected antagonistic endophytic bacterial strains produced a core set of seven VOCs along with different strain-specific and known antifungal VOCs such as 3-Methylbutan-1-ol, sulfur-containing compounds, 2-Heptanone and Dodecanal. Tomato fruit bio-protection assay showed that the *Enterobacter* strain TR1 produces the most protective VOCs against *B. cinerea* infection with 3-Methylbutan-1-ol as a major volatile compound which totally suppressed *B. cinerea* growth and infection on tomato fruit at 0.442 mL L⁻¹ headspace, whereas the *Bacillus* strains showed better protection against fungal infection when applied as vegetative cells on tomato fruit. These results support the use of the selected strains as potential biocontrol agents to reduce postharvest decay of *B. cinerea*, as well as 3-Methylbutan-1-ol as promising antifungal volatile to apply during postharvest commercialization of tomato fruit.

Keywords: *Antifungal activity; Endophytic bacteria; Gray mold disease; Plant Growth Promoting activity; Solanum lycopersicum; Volatile organic compounds.*

BIOLOGICAL PROTECTIVE SUBSTANCES IN A SPONTANEOUS HALOPHYTE FROM ALGERIAN SAHARA

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Abstract

The current study comes to evaluate the oral anticoagulant toxicity, of a spontaneous halophyte extract from south-eastern Algeria, against black rats (*Rattus rattus*). Four doses were chosen (100, 150, 200, and 300mg/day/kg of individual weight) and a control. UPLC-ESI/MS chromatography detected three separated coumarins. Whereas, the fraction of this plant revealed that the 4th dose applied has the highest death number. After 48h of treatment, lethargy, anorexia, and loss of consciousness was observed in all the tested rats with a sudden death after only 72h. Furthermore, the LD₅₀ of this fraction recorded a dose of 146.4 mg/kg with LT₅₀ estimated by 59.37 h to execute the death of 50 % of treated rats. At the end of the experiment, the dissection of all the dead individuals allowed us to observe that their internal organs were all bleeding. The analysis of intrinsic and extrinsic pathway factors (PT and aPTT) revealed that both extracts have an anticoagulant activity increased in accordance with the concentration. On the other hand, the histological sections of the liver indicated the presence of cellular alteration, significant necrosis, and cellular infiltration inflammation of the portal space. Also, in the kidney of all the treated rats, we have observed vascular congestion with an inflammatory filtrate.

Keywords: *Halophyte, Biological control, Rodenticide, Anticoagulant, internal organ bleeding.*

FUSARIUM HEAD BLIGHT ON DURUM WHEAT IN ALGERIA: MOLECULAR IDENTIFICATION OF CERTAIN FUSARIUM ISOLATES AND ASSOCIATED CHEMOTYPES

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Abstract

Over the past decade, several research studies conducted in Algeria point to the importance of fusarium head blight caused by different species of *Fusarium* severely affecting durum crop yields and the technological and health quality of grain by mycotoxin production. The present study reports the molecular identification of *Fusarium* isolates species infecting durum wheat cultivated in Algeria. In our previous work, the characterization of the isolates was initially carried out on morphological criteria. To this end, their morphological characterization has enabled us to identify the isolates such as *F. culmorum* and *F. graminearum*. Thus, the main objective of this work was to confirm by molecular studies the species of each isolate and to identify their chemotyping type. Molecular identification was performed by PCR assays using species-specific primers. The results showed that more than 40 % (3/7) of the isolates belong to the *F. culmorum* species. This research also revealed, for the first time, the presence of *F. cerealis* (*F. crookwellense*) in Algeria. According to these results, it can be seen that the morphological identification results are not in agreement with those of the molecular identification, which confirms that the first method of identification remains really very insufficient to characterize such a *Fusarium* isolate and in this case, we are obliged to go through the method of molecular identification. Finally, the use of primer assemblies allowed to emphasizing that the majority of isolates were of the DON chemotype; only two isolates were found to be NIV chemotype.

Keywords: *Fusarium head blight, durum wheat, Fusarium species, Algeria.*

IN VITRO AND IN VIVO EFFECT OF ROSMARINUS OFFICINALIS L. ON THE DEVELOPMENT OF ASPERGILLUS SP

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Abstract

Rosmarinus officinalis L. belongs to the lamiaceae family ^[1]. It appreciates warm or moderately dry climates ^[2]. In the region of Bechar, *Rosmarinus officinalis* L. is fairly widespread in the Antar and Grouz mountains; it is traditionally intended for the conservation of date pasta. The aim of this study is to evaluate the antifungal potential of the leaves aqueous extract of this plant in order to fight the fungal flora contaminating post-harvest apples. Isolation and identification of fungi from rotten apple fruit has shown the presence of *Aspergillus* sp. The aqueous extract of *Rosmarinus officinalis* L. was evaluated by the direct contact method for their antifungal activity on radial growth on solid medium as well as on the sporulation of isolated *Aspergillus* sp. Then, an *in vivo* test on apple fruit was carried out curatively and preventively to calculate the incidence and severity of the disease. A weak inhibitory activity even also a stimulator effect of the growth and sporulation of *Aspergillus* sp, has been observed *in vitro* under the effect of the aqueous extract of *Rosmarinus officinalis* L. The *in vivo* results indicated that the incidence of the disease caused by *Aspergillus* sp in the presence of curative treatment with the aqueous extract of *R. officinalis* L. increased with time until stabilization at 100% in 5th day, and the severity of the disease has decreased with time in the presence of curative and preventive treatment with this extract. The aqueous extract of *Rosemary* has shown promising effects for the use of this plant to control post-harvest diseases.

Keywords: *Rosmarinus officinalis* L, Aqueous extract, *Aspergillus* sp, fungal activity, Apple.

ANTIOXIDANT, ANTI-INFLAMMATORY, AND CYTOTOXIC ACTIVITIES OF *OPUNTIA* SPP.

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Abstract

Opuntia spp. have been used in traditional medicine for many centuries. It is used in the management of diseases that involves oxidative stress, especially diabetes, obesity and cancer. *Opuntia stricta* is one of the relatively unknown species in Algeria where it is regarded more as a weed. Because of this, not much is known about its chemical composition. The aim of our research was to determine the antioxidant, anti-inflammatory and cytotoxic activities of *Opuntia* spp. The phytochemical composition of ethanol extract of seeds of *Opuntia* spp, as well as the vitamins A, C and E of its dried weight seeds and the antioxidant activities was evaluated using standard in vitro methods. The anti-inflammatory and cytotoxic activities were evaluated using cell-based assays. The antioxidant activities were determined by DPPH and hydrogen peroxide scavenging antioxidant activity. Anti-inflammatory activity was determined using RAW 264.7 cells, while cytotoxicity was determined using MCF-7 cells. The phytochemical composition showed a significant difference in the various extracts. The total phenolics were higher than other phytochemicals in all the extracts used. All the extracts displayed antioxidant activity, while most of the extracts showed anti-inflammatory activity. Only one extract showed cytotoxicity, and it was mild. The results show that the *Opuntia* spp. is rich in polyphenolic compounds and has good antioxidant activity as well as anti-inflammatory activities.

Key words: *Opuntia Spp*, phenolic compounds, antioxidant, anti-inflammatory, cytotoxicity.

SWEET GRAPE PRODUCTION IN BANGLADESH BY ADJUSTING PRUNING CYCLE

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Abstract

After 21 years of the trial it has become successful to produce sweet grape in IUBAT. The experiment was started in 1997 while the author had been working at James Finlay Limited, Balisera, Sremangal. Both normal flowering and pruning induced flowering were under trial during the long study period to attain a stable result. Seasonal shifting of monsoon rain had been destabilizing the pruning adjustment to fruiting and ripening phases of the grapes. The trial parameters were: Normal flowering without pruning, late winter pruning, spring pruning, Monsoon pruning and autumn pruning. At all the parameters flowering and fruiting were observed and fruits were tasted. Although autumn (September) and late winter (February) pruning showed some sweetness of the grapes but in next trials grapes were sour. However, Monsoon pruning resulted in very sweet grapes and was confirmed by repeated trials. Both spring and monsoon pruning showed luxuriant vine growth but other parameters vegetative growth was less. The present pruning time ‘the first week of the August’ has already been practiced earlier and now confirmed the sweetness of the grapes in IUBAT Agricultural field condition.

Keywords: sweet grape, pruning.

CHANGES IN CHEMICAL AND MICROBIOLOGICAL INDICATORS OF UNSTERILIZED CONCENTRATED CARROT JUICE DURING STORAGE

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Abstract

Carrot is one of the main vegetable crops grown in Belarus on an industrial scale. The processing of carrots into concentrated juices is of particular relevance, since this product is in demand by various manufacturers in the food industry. The purpose of this work is to study the changes in the chemical and microbiological parameters of unsterilized concentrated carrot juice to determine its shelf life. The object of the study were samples of unsterilized concentrated carrot juice obtained under production conditions and stored at $T=4\pm 2^{\circ}\text{C}$. Sampling for research was carried out monthly, studying the change in the number of bacteria, yeast and mold, the pH, water activity and mass fraction of titratable acids. It was found that the growth of the number of bacteria occurred almost evenly during the four months of storage, reaching tens of thousands of CFU/g. Active reproduction of yeast and mold began after 3 months of storage, reaching a maximum number (several hundred CFU/g) by the 4th month of storage. Further storage of juice samples (up to six months) did not lead to a noticeable development of the microbiota. The value of water activity varied within 0.865–0.900; the mass fraction of titratable acids varied from 0.2 to 0.3%; the pH increased from 4.6 to 5.1 during the first month of storage and then decreased to 5.0 and remained constant. Thus, we can conclude that the shelf life of unsterilized concentrated carrot juice should not exceed three months at $T=4\pm 2^{\circ}\text{C}$.

Keywords: *Unsterilized concentrated carrot juice, microbiota, chemical indicators, shelf life*

SPECIES OF THE GENUS *PYRENOPHORA* - BARLEY PATHOGENS IN REPUBLIC OF SRPSKA AND THE WORLD

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Abstract

Pathogenic species of the genus *Pyrenophora* are significant causes of diseases on barley and other small grains. Almost, there aren't literary references related to the species of the genus *Pyrenophora* in our country, although the presence of symptoms manifested in the form of various types of spotting, necrosis and drying of the diseased tissue of barley leaves, which indicate the potential presence of species of this genus, has recently been found in a large number of barley production plots. The significance of this phenomenon is all the greater because the symptoms caused by certain species of the genus *Pyrenophora* on diseased barley leaves are in most cases difficult to distinguish visually, so correct diagnosis is the basis for their successful suppression and prevention of damage that occurs almost regularly in the field. Bearing all this in mind, the composition of the mycopopulation of fungi originating from the necrotic tissue of diseased barley leaves was studied. A large number of samples of diseased barley leaves with characteristic symptoms were collected from a large number of barley production plots in 50 different localities from the entire territory of the Republic of Srpska, during May and June 2021 and 2022. Through the laboratory analysis of samples collected at the Agricultural Institute of the Republic of Srpska, Banja Luka, we determined that the mentioned changes on the diseased barley leaves were caused by two species from the genus *Pyrenophora*, namely: *P. teres* and *P. graminea*. Further research is ongoing and with this work we want to give an overview of the distribution, economic importance, symptomatology, life cycle and measures to control pathogenic species of the genus *Pyrenophora* that can appear as pathogens of barley in the world, among which, apart from the two established species, the most significant are *P. tritici-repentis*, *P. semeniperda*, *P. erythrospila*, *P. trichostoma* and *P. wirreganensis*.

Key words: *barley, Pyrenophora* spp., *disease, control of disease.*

**THE HARMFULNESS OF APPLE BLOSSOM WEEVIL (*Anthonomus pomorum* Linne)
ON DIFFERENT APPLE VARIETIES IN THE REGION OF EAST SARAJEVO IN
BOSNIA AND HERZEGOVINA**

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Abstract

The apple blossom weevil (*Anthonomus pomorum* L.) is a widespread pest in world. worldwide. It's present in all apple-growing regions and represents one of the most significant pests of generative organs of the apple. The harmfulness of this species in region of East Sarajevo (entity of Republic of Srpska, Bosnia and Herzegovina) was examined in 2022. in extensive plantation in the locations Kula and Klek. In Kula, examination was done on the varieties: Jonagold, Golden Delicious, Idared, Granny Smith and Melrose. In Klek, the examination included varieties: Jonagold, Golden Delicious, Braeburn, Gloster and Fuji. Using entomological methods such as visual inspections of trees, method of shaking branches and method of sampling of 100 flower buds, the presence and harmfulness of *A. pomorum* on different apple varieties was determined. The higher percentage of damaged flower buds was in the location Kula (27.2). The highest percentage of damaged flower buds was found in the variety Golden Delicious (41), while the fewest damaged flower buds were on the variety Melrose (12). In the location Klek, out of the total number of examined, 22.4 percentage of flower buds were damaged. The highest percentage of damage was determined on the variety Breburn (37), and the least on the variety Fuji (9).

Keywords: *apple blossom weevil, apple, varieties, East Sarajevo.*

EFFECT OF VARIOUS SUBSTRATES ON GROWTH AND SPORULATION OF SELECTED ISOLATES *ALTERNARIA* SPP

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Abstract

Six selected isolates of *Alternaria* spp. were used in these studies, as follows: A: 1) FM-15; 2) BM-2; 3) CLA-108 monitoring *A. dauci* isolates; B: 4) Mr-114; 5) IM-14, and 6) Aa-82 control isolate for *A. alternata*. Testing the effect of nutrient substrate on the growth and sporulation of selected isolates of *Alternaria* spp. was conducted on five different agars as follows: potato dextrose agar (PDA), V8 agar (V8A), Water agar (WA), Malt agar (MA), and Carrot leaf agar (CLA). The growth rate was determined after inoculation by measuring the diameter of the colony after 3, 5, 7 and 10 days in five replications, while the intensity of sporulation was expressed through the number of conidia per 1 cm² of colony. The largest radial growth of colonies of all three isolates from group A studied was achieved on V8 agar, while the isolates from group B studied achieved a slightly higher growth on PDA. The influence of nutrient substrate on the intensity of sporulation in the isolates from studied group B was abundant and very abundant, while sporulation in isolates of group A was absent on all agar, except for two isolates.

Keywords: *Alternaria alternata* isolates, *Alternaria dauci* isolates, nutrient substrate, radial growth, sporulation.

ANTIMICROBIAL RESISTANCE OF *SALMONELLA ENTERITIDIS* & *SALMONELLA TYPHIMURIUM* ISOLATED FROM FOODS OF ANIMAL ORIGIN

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Abstract

The problem of resistance to antimicrobial drugs was mostly associated with the spread and mechanism of resistance in human pathogenic bacteria. However, the appearance of resistance in zoonotic bacteria began to affect therapeutic interventions in humans as well. The use of antibiotics in animals whose meat is used for human consumption has opened the question of developing resistance in the animal's body, as well as the possible transmission of resistant bacteria through the food chain to humans and the development of foodborne illnesses that are difficult to treat. *Salmonella* is one of the leading foodborne pathogens. They are a common cause of alimentary infections in humans. Secondary contamination of salmonella is also possible along the entire food chain. Salmonellosis is a self-imitating infection, so antimicrobial therapy is used only in children, older people and in cases of systemic infections. Serotypes *S. Enteritidis* and *S. Typhimurium* lead to most gastrointestinal infections of humans, pathogenic for animals as well and the outcome of infection ranges widely, from severe systemic diseases to asymptomatic conditions. The aim of the study is to examine the sensitivity of *Salmonella Enteritidis* and *Salmonella Typhimurium* serotypes (isolated from food) on antimicrobial drugs. To investigate the susceptibility of salmonella to antimicrobial drugs a disc diffusion method was used. To perform the disk diffusion method, disks of the manufacturer "Conda" and Oxoid were used. All tested isolates were 100% resistant to imipenem (IMI), linkomycin (MY), bacitracin (LS), canamycin (K), vancomycin (VA) and cefuroxime (CXM), 80% on nalidic acid (NA) and 40% amiac acid isolates (AK) and gentamicin (CN). Moderate susceptibility to amoxicillin (AML) and tetracycline (TE) showed 60% of isolates 20% according to amiacin (AK) and gentamicin (CN).

Keywords: *antimicrobial drugs, antimicrobial resistance, multi-residue strains*

ALLIUM URSINUM: MICROBIOLOGICAL AND ANTIBACTERIAL PROPERTIES

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Abstract

Allium ursinum is so far under-tasted an edible plant species that is used both in culinary and traditional medicine. The aim of this work is to investigate the microbiological property and antibacterial activity of *Allium ursinum* plants from the territory of Republic of Srpska. Microbiological activity was determined by standard ISO BAS methods for *E. coli* and total number of bacteria. Antibacterial activity was determined by disk diffusion method. *Allium ursinum* showed antibacterial activity on *S. Enteritidis* and *S. Typhimurium* isolated from food. Based on the results, it can be concluded that *Allium ursinum* is useful as a dietary supplement because it can participate in the control of certain pathogens that can be found in food and the environment.

Keywords: *Allium ursinum*, microbiological safety, antibacterial activity

ANALYSIS OF FATTY ACIDS IN SELECTED SAMPLES OF COCONUT OIL

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Abstract

Edible oils of plant origin are a rich source of fatty acids and lipophilic antioxidants. In addition to contributing to a high energy value in the diet, oils contain high nutrients, vitamins, and minerals that are beneficial to human health. Among them are oils obtained from coconut kernel, which include dill oil (CO), virgin coconut oil (VCO), and refined, bleached, and deodorized (RBD) oil. Depending on the method of preparation, their composition and biological effects vary. This study aimed to determine the content and composition of fatty acids in different samples of coconut oils that can be found on the market of the Republic of Serbia. Gas chromatography with a flame ionization detector determined the content and composition of fatty acids in different samples. Statistical processing of the data presents the results as percentages of individual fatty acids concerning the total. In addition, the compared physicochemical and biological properties of coconut oils prepared by different methods were performed. It was observed that there is no significant difference in the percentage of fatty acids in different samples of coconut oil. All samples contained the highest rate of lauric acid, 49.31 ± 0.63 relative to total fatty acids. It is followed by myristic (19.35 ± 0.46), caprylic (7.16 ± 0.68), and palmitic (8.47 ± 0.68). The content of monounsaturated acids, oleic (5.19 ± 0.44) and linoleic (0.84 ± 0.12), is highest in samples of the virgin, cold-pressed oils. As the percentage of monounsaturated fatty acids is small, it can be concluded that the tested oil is relatively stable, i.e., resistant to thermal modifications. Therefore, it is best to use them as edible unrefined vegetable oils due to the preservation of active ingredients with favorable health effects.

Keywords: *coconut oil, saturated and unsaturated fatty acids, gas chromatography.*

IN-VITRO AND IN-VIVO ANTIFUNGAL ACTIVITY OF FERMENTED COCOA'S RESIDUAL HONEY AGAINST WITCHES' BROOM DISEASE

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Abstract

Last decades, Brazilian cocoa agribusiness had suffered with the negative impacts caused the witches' broom disease, caused by the fungus *Monilophthora perniciosa*. Currently, eco-friendly measures are developed to control the spread of this phytopathogen. The main objective of this work is to contribute to the reverse logistics and enhancement of cocoa's residual honey (CRH) as a natural biofungicide in plants of the *Theobroma cacao* against witches' broom. More specifically, this work explores the potential of the CRH (Tome-Açu/PA, Brazil) fermented during 4 years to inhibit the germination and the growth of *M. perniciosa* (isolated cac-257, CEPLAC/PA, Brazil) through in-vitro and in-vivo essays (using seedlings of the PA-195 genotype of *T. cacao*) compared to negative control. The *in-vitro* essays were performed using 10 diluted solutions of CRH with 3 replications. A gradual reduction of the germination and growth was observed with increasing doses of CRH. In particular, CRH promoted 100% of inhibition in the concentration of 2%. The *in-vivo* essays were carried out using 10 seedlings with 4 replications. Four days after spraying the CRH at a concentration of 5%, the seedlings were subjected to inoculation with the fungus. The results evaluated 45 days after inoculation show a reduction of 5% of the seedlings that present the manifestation of the disease compared to the negative control. The CRH has proved to be a sustainable, low economic and efficient biofungicide against *M. perniciosa* in plants of the *T. cacao*.

Keywords: *Reverse logistics, valorization, biofungicide, Theobroma cacao, Monilophthora perniciosa.*

PRIMARY METABOLISM PROFILE AND CAROTENOIDS ANALYSIS OF POSTHARVEST TOMATO FRUITS ELICITED BY ULVAN

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Abstract

The percentage of food losses on average can reach 40% worldwide along crops' postharvest supply chain. Currently, the main way to fight both pre- and postharvest diseases in horticultures such as tomatoes (*S. lycopersicum*) is to use synthetic fungicides which can be harmful to the health of a consumer and whose indiscriminate use can accelerate the process of selecting resistant pathogenic varieties. In order to fight or prevent crop pathogens, breeding of resistant cultivars through genetic engineering and stimulating the plant's innate immunity through elicitors may be implemented. Elicitors are molecules or agents that play a role in the triggering or stimulating of defense mechanisms in a plant. Such resistance may be activated, for example, by polysaccharides from marine algae, including those ones from the green macroalgae of the genus *Ulva* (ulvan) which have been reported in the literature as biostimulants as well as potential elicitors, acting in the activation of the jasmonic acid and phenylpropanoid pathways. Thus, the purpose of the present study was to evaluate the role of ulvan as a elicitor of postharvest tomatoes defenses through the analysis of the polar and non-polar metabolites profiles by GC/MS and carotenoids content analysis by HPLC. The experimental design comprised samples of organic tomatoes (cv sweet grape) to which ulvan solutions were applied by injection or immersion (10 μL , $c = 1 \text{ mg}\cdot\text{mL}^{-1}$). Controls were inoculated (10 μL of sterile water). According to our preliminary results, there is a substantial enhancement response in the primary metabolism of the treated samples.

Keywords: *Solanum lycopersicum*, Organic tomato, Ulvan, Elicitation, Postharvest treatment.

CONTRIBUTION OF NON-TIMBER FOREST PRODUCTS TO RURAL HOUSEHOLD FOOD SECURITY IN BURKINA FASO

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Abstract

Eradicating hunger, ensuring food security, improving nutrition, and promoting sustainable agriculture around the world is the second Sustainable Development Goal that the United Nations adopted in 2015 for 2030. The fight against hunger and, food and nutrition security in rural areas can be achieved through the contribution of Non-Timber Forest Products (NTFPs) to the diet of households living there. This essay attempts to characterize the contribution of NTFPs to the food security of households bordering the Pô-Nazinga-Sissili protected area complex in Burkina Faso. Using primary data collected from a sample of 263 randomly selected households, two food security indicators were calculated. These indicators are the Household Dietary Diversity Score (HDDS) and the Household Food Insecurity Access Scale (HFIAS). Binary logistic regression and ordered multinomial logistic regression of these respective indicators on the socio-economic characteristics of households, with a particular focus on economic dependence on NTFP, have shown that NTFPs are a means of securing household food. Thus, it would be more appropriate for NTFPs to be better incorporated into public policies on food and nutrition security, especially in rural areas.

Keywords: *Non-Timber Forest Products, Food Security, Household Dietary Diversity Score, Household Food Insecurity Access Scale, Burkina Faso.*

DESIGN AND DEVELOPMENT OF A PADDY RICE PARBOILING SYSTEM

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Abstract

The need to improve on parboiling techniques for rice farmers in Cameroon has led to the development of a rice parboiling device as a research unit in Agricultural Engineering, University of Dschang. The design and construction was carried out using an empty 0.2 m³ metal oil drum for the parboiler, which is made up of the soaking (0.1585 m³) and steaming (0.0919 m³) chambers divided by a perforated floor of 0.26 m². The performance results of the developed parboiling device were compared with results from traditional and industrial methods of parboiling. A water uptake test was carried out and a panel subjective test was used to compare the sensory and cooking quality of the rice for the developed parboiler, traditional and industrial parboiling methods. The developed parboiler used 2.5 kg of firewood to parboiled 50 kg of rice in 2hrs15mins at a soaking and steaming temperatures of 90 and 95 °C respectively. The traditional parboiler used 9.8 kg of wood to parboil 50 kg of rice in 3 hours at a steaming temperature of 105 °C. Panels' assessment showed that the quality of rice parboiled with the developed parboiler was good compared to the traditional and industrial methods. Overall results showed a significant improvement, less time of operation and a cheaper cost using the developed parboiler. The null hypothesis of this study concluded that there is no significant difference in the water uptake of the rice parboiled using the developed, industrial and traditional parboilers at varying temperatures (P = 0.05). This improved parboiler is 4 times greater in its construction cost with an 81.56% average output compared to traditional parboiler.

Keywords: *Paddy, Parboiling, Rice, Soaking, Steaming.*

POSSIBILITY OF BIOLOGICAL CONTROL OF ADULT STINK BUGS *NEZARA VIRIDULA* AND *HALYOMORPHA HALYS* BY APPLYING THE AQUEOUS RAGWEED EXTRACT

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Abstract

Stink bugs are a growing problem in Croatia. They have caused significant economic damage to various fruit, vegetable, and field crops and it is reported that they utilize over 100 plant species as feeding or reproductive hosts. Southern green stink bug (*Nezara viridula* L., 1758.) and brown marmorated sting bug (*Halyomorpha halys* Stål, 1855.) are the dominant species from the Pentatomidae family in Croatia, while *Ambrosia artemisiifolia* L. is an invasive and aggressive weed present throughout the country. The aim of the study was to determine the toxicity of aqueous extract of *A. artemisiifolia* to adult individuals of *N. viridula* and *H. halys* under laboratory conditions. The study was conducted under laboratory conditions in September 2021 in three treatments: aqueous ragweed extract at a concentration of 10%, azadiractin (Ozoneem Trishul® -1%) and water as a control. Treatments were set in four replicates and a total of 240 adults stink bugs (120 *N. viridula* and 120 *H. halys*) were included in the experiment. All treatments showed mild toxicity. *H. halys* was more sensitive to the aqueous ragweed extract compared to *N. viridula*. Statistically significant differences in mortality between treatments were found in *H. halys* species 10–14 days after treatment with aqueous ragweed extract. Since no high efficacy of ambrosia extract has been found in the adult stage, research will continue on eggs and larvae that have a higher degree of sensitivity to aqueous and ethanolic extracts compared to the adult insect stage.

Key words: *Nezara viridula*, *Halyomorpha halys*, adults, aqueous ragweed extract, azadiraktin.

THE USE OF RGB AND HYPERSPECTRAL IMAGING IN DETECTION OF CODLING MOTH AND ITS DAMAGES ON APPLE

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Abstract

Codling moth is a cosmopolitan pest that causes economically significant damage in apple production. The damage is visible on the fruits, which lose their organoleptic properties and market value. Therefore, the use of artificial intelligence offers a good perspective for the early detection of the pest and its damage in the field. Information and communication technology has contributed to the use of intelligent devices throughout the agricultural chain. In the context of precision agriculture, the artificial intelligence system is a comprehensive solution for the digitalization of agriculture. In practice, this system involves the creation of an information database, and in the case of pest monitoring, red-green-blue (RGB) and hyperspectral imaging cameras (HSI) can be used. These cameras record the occurrence of pests and damage in orchards. Later, these photos are processed using machine learning methods. Based on all the data, accurate models are developed to identify the target pest and facilitate monitoring and management. Inhibiting factors for the use of cameras can be the high market price, the lack of certain electronic components, and the required expertise. Nonetheless, high-precision classification models for pest monitoring represent the future of agriculture and offer a new opportunity to reduce economic losses caused by codling moth.

Keywords: *Precision agriculture, Artificial intelligence, RGB and HSI cameras, Cydia pomonella L., Apple production.*

ALLELOPATHIC EFFECT OF ESSENTIAL OILS ON LETTUCE (*LACTUCA SATIVA* L.) AND REDROOT PIGWEED (*AMARANTHUS RETROFLEXUS* L.) GERMINATION

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Abstract

The aim of the study was to investigate the allelopathic effect of thyme (*Thymus vulgaris* L.) and star anise (*Illicium verum* L.) essential oils on germination of lettuce (*Lactuca sativa* L.) and redroot pigweed (*Amaranthus retroflexus* L.) seeds. The allelopathic potential was assessed through two experiments to determine both the volatile effect and direct contact of essential oils. A solution of essential oils in two concentrations (0.1 and 1%) was prepared for the experiments. In the experiment with the volatile effect, the seeds of the test species were germinated in Petri dishes on filter paper moistened with water, while a solution of essential oil was applied to the filter paper attached on the upper side of the lid. In the experiment with direct contact, the seeds of the test species germinated in Petri dishes on filter paper moistened with a solution of essential oils. In the control treatment, the seeds of the test species were germinated without essential oils using only distilled water. Results showed that in the treatments with oils, seed germination of both test species was significantly reduced, and the degree of inhibition depended on the oil type, concentration and applied method. Higher concentrations of thyme and star anise essential oils completely inhibited (100%) germination of lettuce seeds in both methods. The reduction of redroot pigweed germination ranged from 5.6 to 100% with direct contact, while germination inhibition ranged from 43.5 to 100% with volatile effect. On average, thyme oil showed stronger inhibitory potential in both experiments.

Key-words: *allelopathic effect, salad, in vitro, thyme, star anise.*

ANALYSIS OF COCOA BEANS FROM DIFFERENT REGIONS IN TOGO

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Abstract

In this study, we compare beans of *Theobroma cacao* from different regions of Togo with the aim of understanding differences in cocoa bean quality. Togo is a west African country, in the Gulf of Guinea, located between the latitudes 6° and 11° north, it is therefore in the tropical equatorial zone. The country extends over 600km from north to south and 160km from west to east. This explains the diversity of climatic influences within it. Indeed, it is possible to identify two distinct zones: a tropical Guinean climate with 4 seasons in the south and a Saudi climate with two seasons in the north. These differences in climates imply diversity in agrarian conditions, which in term are known to impact in the composition of cocoa beans (1). The composition can also be influenced by the genetic variety of cocoa beans. Among the varieties present in Togo, the Forastero variety is in the majority, followed by Trinitatio, whereas the Criollo variety is not very abundant. Moreover, irrigation and soil fertility conditions combined with post-harvest techniques affect quality. The amount of triacylglycerol in cocoa beans can vary depending on its origin, environmental conditions, and agricultural practices. The aim of the study is therefore to analyse and compare the quality of different beans of different regions in Togo with respect to bean attributes such as color or size distribution, sensory attributes as well as fermentation profile. We use thermal analysis (DSC), visual analysis (Cut Test), Sensory analysis using a test panel for the identification and differentiation of cocoa beans from different origins. Differential Scanning Calorimetry (DSC) allows for a determination of a rough lipid profile. The cut test allows the analysis of the fermentation during the post-harvest processes observing their coloration and compartmentalization, which are two characteristics fundamentally related to the chemical composition. Sensory analysis is used in conjunction with previous analyses; it allows highlighting correlations between observed physicochemical properties and sensory qualities analysed.

Keywords: *cocoa, cacao, Togo, climate conditions, quality.*

PRELIMINARY STUDY OF PHENOLICS AND ANTIOXIDANT ACTIVITY IN WHITE WINES PRODUCED IN NORTHERN GREECE

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Abstract

Grapes, especially colored varieties, represent a rich source of phenolic compounds with a beneficial impact on human health. White grapes and subsequently white wines contain smaller amounts of phenolic compounds than the colored ones. However specific winemaking techniques, (e.g. pre-fermentative maceration) and ageing within the wooden barrels are reported to increase the phenolic content and the antioxidant activity of the produced wines. This is an exploratory study which aims to evaluate the phenolic content and the antioxidant activity in white wines produced in northern Greece with various winemaking techniques. A total of 30 varietal wines, comprising four grape varieties, produced in different winemaking areas of Northern Greece, i.e. Drama, Kavala, Thessaloniki, Florina, Pieria, and Chalkidiki were tested. Chromatic characteristics of wines and total phenolic content (TPC), as well as their antioxidant activity with 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay, were determined spectrophotometrically. Physicochemical parameters were determined according to official methods of the International Organization of Vine and Wine (OIV). The results were elaborated using the appropriate statistical analysis in order to reveal possible correlations among the parameters measured. The total phenolic contents ranged from 139.1 to 1469.7 $\mu\text{g/mL}$ GAE (gallic acid equivalent) whereas, the antioxidant activity of the samples varied from 114.9 to 1049.5 $\mu\text{g/mL}$ TE (Trolox equivalents). The highest phenolic content and antioxidant activity were found in one orange wine. During the production of orange wine the grape skins and seeds remain in contact with the grape juice for a longer period than in the classic white winemaking. A significant positive correlation ($r = 0.724$, $p \leq 0.01$) was observed between the TPC and antioxidant activity measured with the DPPH assay. Although wines studied were high in phenolics, more research is needed to characterize the profile of phenolics present in grapes and wines produced from Greek native grape varieties and assess their antioxidant activity.

Keywords: *total phenolic content, wine, antioxidant activity, native grape varieties.*

STUDY OF THE EFFECTS OF AN INSECTICIDE (CHLORPYRIFOS) AND A FUNGICIDE (TEBUCONAZOLE) ON CHICKEN EMBRYOS

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Abstract

This study aimed to determine the individual and combined toxic effects of Pynex 48 EC, a chlorpyrifos-based insecticide (480 g/l) and the Mystic 250 EW, (250 g/l tebuconazole) on the early embryonic development of chicken embryos. Chicken eggs were immersed in the emulsions of the test substances for 30 minutes before the start of the incubation. The insecticide concentration used was 0.4%, and of the fungicide was 0.4%. Subsequently, on the third day of incubation, permanent preparations were made from the embryo to study the early developmental stage. Embryos fixed on slides and stained with osmium tetroxide solution were studied under a light microscope. In addition, embryo mortality and their abnormalities were analyzed by the Fisher test. The single and simultaneous administration of Pynex 48 EC increased the mortality up to 20%, but the changes were not significantly different from those in the control group. In addition, the rate of developmental abnormalities did not differ statistically between treated and control groups. Based on the results, there is presumably an addition-type toxic interaction between Pynex 48 EC insecticide and Mystic 250 EW fungicide that may reduce the viability of the embryos.

Keywords: *chlorpyrifos, tebuconazole, interaction, ecotoxicology, chicken embryo.*

PHYTOTOXIC AND MUTAGENIC EFFECT OF 'HERABAN' [CHLORPYRIFOS 20% EC] ON *ALLIUM CEPA*

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Abstract

Phytotoxic and mutagenic effect of Chlorpyrifos has been evaluated on *Allium cepa* plant [meristematic cells]. The test concentrations were 250 ppm, 500 ppm, 1000 ppm, 1500 ppm, 2000 ppm & 2500 ppm, where 2000 ppm is field recommended dose.. Mutagenic effects of CPS were recorded from cytological studies. Metabolic variation in response to CPS toxicity was measured by using morphological and biochemical parameters. Chromosomal aberrations, mitotic index, nucleolus assay of applied pesticide on *Allium cepa* root were determined to check the effect of CPS on plant for recommended dose, lower doses and slight higher dose. From this studies it was found that CPS highly affects cell cycle and induce several anomalies, decrease pigment production and germination frequency. At higher concentration i.e., higher than recommended dose it acts as a strong mutagen and induces cell death. The present study reveals that the farmer recommended dose of CPS causes severe damage to the test plant as evidenced by the appearance of various types of cytological and chromosomal and biochemical abnormalities. Finally, it can say that 500 ppm can be recommended dose for protection of crops need to check whether it is able to control the pest or not in question.

Keywords: Chlorpyrifos, *Allium Cepa*, toxicity.

BIOACTIVE COMPONENT FROM *MESSUA FERREA* AGAINST INSECT PESTS: A POTENTIAL AMYLASE INHIBITOR

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Abstract

Pre harvest and postharvest damage of crop plants due to insect pests causes severe losses to the agricultural production worldwide. Plant proteinaceous and non-proteinaceous molecules have potential to restrict the growth of insect pests by inhibiting their digestive enzymes such as proteases and amylases. In the current study, we have screened several secondary metabolites isolated from traditional Indian herbs and tested them for presence of inhibitory activity against salivary and insect amylases. We found that the methanol and acetone extracts of *Messua ferrea* seeds possess excellent amylase inhibitory activity. It showed maximum inhibition of salivary and insect amylases in dot blot and solution assays as well. Bioactive molecules from the seed extracts were separated and purified by using Thin Layer Chromatography (TLC). The purified bioactive component was interacted with salivary and various insect pests by using starch PAGE zymogram. It is found potentially promising *invitro*. Feeding assays supportably exhibited toxic effects of purified bioactive component on insect's growth and survival. The obtained information could be useful for designing transgenic strategies that would confer resistance to crop plants produce against post-harvest infesting insect pests.

Keywords: *Bioactive molecules, secondary metabolites, amylase inhibitors, insect amylases, Thin Layer Chromatography.*

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.*

MOLECULAR DETECTION OF PHYTOPLASMA CAUSING BIG BUD DISEASE ON TOMATO IN IRAQ

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Abstract

The tomatoes *Solanum lycopersicum* L., is one of the most important crops of the Solanaceae family, as it ranks first in global production, and the statistics of the Food and Agriculture Organization (FAO) indicate that the global production of the tomato crop reached 373 million tons. America, China and Italy are among the most tomato producing (FAO, 2017). Nineveh Province/ Iraq is famous for the cultivation of the tomato crop, as the percentage of the area planted with this crop reached (11.087) hectares. Symptoms similar by the phytoplasma disease "Big bud" were observed on tomatoes (*Solanum lycopersicum* L.) grown in the field in Mosul city, Iraq. Diseased plants were characterized by twisting, corrugated, yellowing or reddening of leaves. The sepals of the flowers acquired hypertrophied form, were fused together and created a bell-shaped sterile bud (phylloidy) of green or anthocyanin color. The stems of the plants were lignified, and phloem necrosis was observed on the stem. In mid-September 2020, samples of 30 diseased and 2 healthy (control) tomato plants were collected from the fields. Phytoplasmas were detected by PCR and Nested-PCR in 10 diseased samples, use primers P1 /P7 and R16F2n/R16R2 .The results of a phylogenetic tree consisting of 27 genetic sequences of the 16 S ribosomal RNA gene of *Candidatus* Phytoplasma trifolii, locally isolated from Iraq/Mosul, showed a sequence identity with a high percentage of genetic similarity of 99% with *Candidatus* Phytoplasma trifolii 16Sr member group phytoplasma clover proliferation (16Sr VI), with various isolates from around the world.

Key words: *Big bud disease, tomato, Nested-PCR, Phylogeny tree, Iraq.*

CONTROL AND RESISTANCE MONITORING OF THRIPS TABACI IN ISRAEL

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Abstract

The onion thrips (OT), thrips tabaci, is a major pest in Israel and inflicts serious damage and significant annual losses in many Allium species, especially by direct feeding and reducing leaf quality. Chemical sprays are the main control method used for reducing OT populations. Among the chemical groups used during the season are spinosad, emamectin benzoate, abamectin and others. The response of OT populations to major insecticides was monitored during the last few years across Israel. The results showed that many populations were able to develop resistance to one or more of the tested compounds, especially very high levels of resistance to spinosad. The resistance to some insecticides was absolute and was responsible, in many cases, for field failures. The levels of resistance to some insecticides changed during and between seasons and were likely related to factors such as the number of sprays, surrounding farms and OT immigrating populations. The response of susceptible and resistant OT laboratory populations to spinosad was tested under different temperature regimes. The results showed strong synergism between high temperatures and the resistance. To improve the resistance monitoring, we developed a fast bioassay and molecular markers for testing the identity and susceptibility of collected OT populations to several major insecticides within 48 hours. This bioassay will be integrated into a larger IPM program for better means of controlling OT in Israel.

Keywords: *Thrips tabaci*, resistance, monitoring, spinosad

TRANSMISSION OF A NEW POLEROVIRUS INFECTING PEPPER BY THE WHITEFLY *BEMISIA TABACI*

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Abstract

Many animal and plant viruses depend on arthropods for their transmission. Virus-vector interactions are highly specific and only one vector or a group of vectors from the same family is able to transmit a given virus. Poleroviruses (Luteoviridae) are phloem-restricted RNA plant viruses, which are exclusively transmitted by aphids. Multiple aphid-transmitted polerovirus species commonly infect pepper, causing vein yellowing, leaf rolling and fruit discoloration. Despite low aphid populations, a recent outbreak with such severe symptoms in many bell pepper farms in Israel led to reinvestigation of the disease and its insect vector. We report that this outbreak was caused by a new whitefly (*Bemisia tabaci*)-transmitted polerovirus, which we coined Pepper whitefly borne vein yellows virus (PeWBVYV). PeWBVYV is highly homologous (>95%) to Pepper vein yellows virus (PeVYV) from Israel and Greece on its 5' end half, while it is homologous to African eggplant yellows virus (AeYV) on its 3' half. By constructing a PeWBVYV infectious clone causing the pepper disease, we were able to fulfill Koch's postulates. The generated virus following agro-infection was in turn transmitted to test pepper plants by *B. tabaci* but not by aphids. Parameters for acquisition and transmission of the new virus by *B. tabaci*, interactions with PeVYV inside aphids and whiteflies, and geographical distribution of both viruses were investigated. PeWBVYV is the first report of a whitefly-transmitted polerovirus.

Keywords: *Polerovirus*, *Bemisia tabaci*, virus, transmission, pepper.

INSECTICIDE RESISTANCE MANAGEMENT FOR FALL ARMYWORM IN MAIZE FIELDS OF ISRAEL

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Abstract

Fall Armyworm (*Spodoptera frugiperda*) (FAW) is endemic to tropical and subtropical regions of North and South America. FAW larvae, if not well managed can cause significant yield losses to various important crops, such as maize, rice and cotton. In Israel, populations of FAW have been found since 2018 damaging many maize fields. Management of FAW relies mainly on the use of insecticides; however, this pest has evolved high resistance levels to many insecticides, worldwide. To prevent or delay the development of insecticide resistance, resistance management strategy should be employed to decrease FAW exposure to insecticides. Our study is focusing on resistance management of FAW and field resistance monitoring to main control agents along with the use of biorational-selective insecticides and other non-chemical methods. The objective of the current study was to establish a baseline susceptibility of FAW larvae to insecticides such as diamides, IGRs and *Bt*. We rear a reference population, without exposure to any pesticide, on artificial diet under standard controlled room conditions. To date, we have assayed various recommended insecticides against third instars of FAW. During May 2022, we have collected larvae of FAW from maize fields, located in the eastern warm valley of Israel and they were tested for their susceptibility to various insecticides. We intend to assay late-season FAW populations as well. An outcome of this study is to form an IPM-IRM strategy that will have the ability to decrease FAW exposure to insecticides and to increase the use of other environmentally-friendly pest control practices.

Keywords: *Spodoptera frugiperda*, Maize, Resistance management, Biorational-selective insecticides, IPM.

DEVELOPING A RAPID PCR-RFLP MOLECULAR TOOL FOR SIMULTANEOUS IDENTIFICATION OF MOTH SPECIES ASSOCIATED WITH CITRUS

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Abstract

Many Lepidopteran species are associated with citrus around the world. Beyond the potential quantitative damage, some moth species are considered to be quarantine pests in different countries, making it difficult to export citrus to those countries. Therefore, in some cases, moths species accurate and rapid identification is essential. The aim of our study was to develop a simple, reliable and fast DNA-based identification method of the most common moth species associated with citrus in Israel. The method is based on PCR amplification of a common region of the mitochondrial cytochrome c oxidase I (COI) gene with the same pair of primers and subjecting the PCR product to a restriction fragment length polymorphism (RFLP) procedure with the same restriction enzyme, making the method universal and reliable for screening many moth species at once. Our results from case studies of moth species collected in the field showed the reliability, accuracy and rapid processing of the samples, compared to sequencing, or morphological identification which can be tedious and lengthy. Ten moth species were tested in this study: *Phyllocnistis citrella*, *Prays citri*, *Ephestia vapidella*, *Cryptoblabes gnidiella*, *Ectomyelois ceratoniae*, *Anatrachyntis badia*, *Thaumatotibia leucotreta*, *Cadra gnidiella*, *Spodoptera littoralis* and *Heliothis peltigera*. The results showed complete accuracy in identifying the moth species, and the method developed here can be extended to other species in citrus and other crops. One major advantage of this method is that any developmental stage, or even a part of the developmental stage, can be used for the analysis.

Keywords: *Lepidopterans, PCR-RFLP, Cytochrome oxidase I, citrus.*

NEW PERSPECTIVES FOR THE CONTROL OF NEMATODES AFFECTING *VITIS VINIFERA* L.

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Abstract

Nematodes constitute an important group of metazoans that represents one of the greatest sources of biotic stress to agricultural plants, as in their biological action they are vectors of virosis. Among the crops that are severely damaged by nematodes (*Xiphinema* and *Longidorus*) is *Vitis vinifera* L. The presence of nematodes adversely affects the cultivation of the grapevine plant and implicitly the production of grapes and wine. In the literature, defense techniques of grapevine, as of other tree crops, are almost exclusively preventive since the real effectiveness of nematicide treatments on plants in vegetation appears, so far, limited. Eliminating these pests from the soil is very difficult since methods and techniques should be adopted such as to create the so-called "biological vacuum" given the nematodes resistance to various remedies. It seems obvious that there is a need to implement environmentally friendly forms of defense; this implies a justified use of possible alternative techniques for controlling nematode infestations. With a view to sustainability, the need for natural solutions was identified, extracting bioactive compounds from plant matrices (endemics, waste matrices, etc.) to be tested for nematostatic and nematicidal action. Methods of sampling/extraction/characterization (sugar centrifugation/flotation and Baermann-funnel, light microscopy) of nematode species traced in real soil matrices were developed. The use of plant extracts derived from waste matrices or from completely unexplored endemics could be a viable solution in the fight against nematodes; in addition, the use of waste matrices incentivized toward an eco-sustainable approach also in terms of circular economy.

Keywords: *Nematodes*, *Vitis vinifera* L., *grapevine*, *nematostatica action*, *nematicidal action*.

CHANGES IN THE QUALITY OF SEA BUCKTHORN (*HIPPOPHAE RHAMNOIDES L.*) OIL DURING STORAGE

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Abstract

The traditional technology for sea buckthorn oil production is extraction with another vegetable oil, usually sunflower. The quality of the obtained sea buckthorn oil depends on the quality of the oil used for extraction. The aim of this study was to compare the quality of sea buckthorn oil extracted with refined and unrefined sunflower oil during two months of storage. The research was done in 2021 at the Agriculture Academy of Vytautas Magnus University. Sea buckthorn berry press cake obtained by squeezing the juice was dried and filled with sunflower oil in a ratio of 2:3. The extraction was performed in the dark at 20 °C for two weeks. The oil was then drained, bottled in dark glass bottles, sealed, and stored for two months in the dark at 5 °C. The total content of carotenoids and β -carotene, the number of peroxides, fatty acids, the induction period, and the oil's colour were determined. Fresh sea buckthorn oil had a higher content of β -carotene (1.3-fold), a higher number of peroxides (2.4-fold) and fatty acids (4.7-fold) when unrefined sunflower oil was used for extraction. The total amount of carotenoids in the sea buckthorn oil was not significantly affected by the type of oil used for extraction. During storage, the total content of carotenoids and β -carotene in both types of sea buckthorn oil decreased, and the number of peroxides and fatty acids increased. The induction period of sea buckthorn oil was prolonged during storage. After two months of storage, the induction period of sea buckthorn oil extracted with refined oil was significantly longer. During storage, sea buckthorn oil lightened but was more intensive in red and yellow colour.

Keywords: *β -carotene, carotenoids, oil, number of peroxides.*

INFLUENCE OF BIOSTIMULANT PHYLGREEN ON CHEMICAL COMPONENTS OF SOFT BERRY

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Abstract

The effect of biostimulant Phylgreen (seaweed *Ascophyllum nodosum* extract) applied as preventive treatments in honeysuckle and blueberry plants exposed to adverse environmental conditions stress was analyzed in this study. The main conclusions of the research were that biostimulant increased the overall yield and quality of berries and level of chemical components in leaves and berries. Phylgreen in rate of 2 l ha⁻¹ positively influenced the overall yield and quality berries: honeysuckle *Wojtek* berries yield was 18.9% and blueberry *Chandler* berries yield - 7.45% higher compared to control. Analysis of berries and leaves showed that the biostimulator influenced the accumulation of anti-stress components in the berries and higher levels of trace elements in the leaves. Honeysuckle *Wojtek* accumulated 7.08% more anthocyanins, 2.23% phenolic compounds, 4.17% ascorbic acid; blueberry *Chandler* 22.67% more anthocyanins and 16.31% phenolic compounds in the berries. Phylgreen did not affect the nitrogen content, mainly increased the amount of trace elements (K, Ca, Mg, S, Cu, Fe, Zn, Mn, Na, Mo) in the leaves. At physiological level, biostimulant increased antioxidant capacity of plants and were able to reduce the oxidative damage generated by heat shock in leaves, thus preventing oxidative stress. Phylgreen like other biostimulants are widely used products to enhance crop tolerance to abiotic stresses, improving crop performance even in the suboptimal conditions, thus increasing crop yield and quality traits. Dealing with different types of abiotic stresses and requires specific solutions to match the biostimulation needs of the plant, from sowing to harvest and from roots to fruits.

Keywords: *biostimulant, berries, anti-stress components*

INFLUENCE OF BIOSTIMULANT PHYLGREEN ON CHEMICAL COMPONENTS OF SOFT BERRY

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Abstract

The effect of biostimulant Phylgreen (seaweed *Ascophyllum nodosum* extract) applied as preventive treatments in honeysuckle and blueberry plants exposed to adverse environmental conditions stress was analyzed in this study. The main conclusions of the research were that biostimulant increased the overall yield and quality of berries and level of chemical components in leaves and berries. Phylgreen in rate of 2 l ha⁻¹ positively influenced the overall yield and quality berries: honeysuckle *Wojtek* berries yield was 18.9% and blueberry *Chandler* berries yield - 7.45% higher compared to control. Analysis of berries and leaves showed that the biostimulator influenced the accumulation of anti-stress components in the berries and higher levels of trace elements in the leaves. Honeysuckle *Wojtek* accumulated 7.08% more anthocyanins, 2.23% phenolic compounds, 4.17% ascorbic acid; blueberry *Chandler* 22.67% more anthocyanins and 16.31% phenolic compounds in the berries. Phylgreen did not affect the nitrogen content, mainly increased the amount of trace elements (K, Ca, Mg, S, Cu, Fe, Zn, Mn, Na, Mo) in the leaves. At physiological level, biostimulant increased antioxidant capacity of plants and were able to reduce the oxidative damage generated by heat shock in leaves, thus preventing oxidative stress. Phylgreen like other biostimulants are widely used products to enhance crop tolerance to abiotic stresses, improving crop performance even in the suboptimal conditions, thus increasing crop yield and quality traits. Dealing with different types of abiotic stresses and requires specific solutions to match the biostimulation needs of the plant, from sowing to harvest and from roots to fruits.

Keywords: *biostimulant, berries, anti-stress components*

QUALITY CHANGES OF COLD-PRESSED SAFFLOWER (*CARTHAMUS TINCTORIUS* L.) AND MILK THISTLE (*SILYBUM MARIANUM* L.) SEEDS OIL DURING STORAGE

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Abstract

Oil from non-traditional seeds, such as safflower and milk thistle has gained increasing popularity in recent years as well as consumers interest in cold-pressed oils. Safflower is a multi-purpose crop, and it is a good source of natural red and yellow dyes from its petals, high oil and protein content. Silymarin is the main component of milk thistle while oil is a by-product of industrial production of this compound. Safflower and milk thistle seeds oil is rich in linoleic and oleic acids, phenolic compounds and other antioxidants, the amount of which and quality of oil changes during storage. The aim of this work was to study the effect of storage time on the quality changes of cold-pressed safflower and milk thistle seeds oil. Seeds oil was obtained using cold press and stored at 4 °C temperature protected from sunlight in dark bottles for 4 months. Free fatty acid content, peroxide value, the oxidative stability as the induction period and fatty acids composition were determined. The investigation indicates that free fatty acids content statistically significant increased after 4 storage months in safflower and milk thistle by 1.3 and 1.8 times, respectively. Peroxide value after 4 storage months in safflower increased from 3.58 to 5.32 and in milk thistle from 0.58 to 1.38. The amount of saturated fatty acids was twice higher in safflower oil before storage than in milk thistle while polyunsaturated vice versa. Investigated seeds oil fatty acids composition has changed significantly during storage.

Keywords: *Non-traditional seeds, Cold-pressed oil, Fatty acids, Oil quality.*

OCCURRENCE OF RADIONUCLIDES AND TOXIC ELEMENTS IN FEED STUFF FROM NORTH MACEDONIA

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Abstract

Animal feedstuff is one of the most common sources of radionuclides and toxic elements which are responsible for poisonings and dangerous exposures that can lead to adverse health effects and potentially death in animals and humans worldwide. The aim of this study was to determine the content of radionuclides and toxic elements in the samples of animal feed collected from areas with intensive agricultural production on the territory of North Macedonia. The radionuclides (^{226}Ra , ^{137}Cs and ^{40}K) were determined in samples of pig feeds, poultry feeds, lamb feeds and cattle feeds by gamma ray spectrometry, while the toxic elements (Pb, Cd and As) were analyzed by electrothermal atomic absorption spectroscopy (ETAAS), including Hg by using cold vapor atomic absorption spectrometry (CVAAS). The obtained results showed that natural ^{40}K was present in all tested samples. The average ^{40}K activity concentration was 192.85 ± 8.50 for pig feeds, 41.95 ± 3.00 for poultry feeds, 117.0 ± 5.50 for lamb feeds and 61.0 ± 1.50 Bq/kg for cattle feeds. The anthropogenic radionuclide ^{137}Cs was not detected. The trend for average concentrations of toxic elements found in the collected feed samples was as follows: $\text{Pb} > \text{Cd} > \text{As} > \text{Hg}$, except in cattle feeds where Cd was found to be present in lowest average concentration. The Hg content (0.038 ± 0.027 mg/kg) was detected to be higher compared to that of As (0.014 ± 0.018 mg/kg) in lamb feeds. All tested samples contained toxic element concentrations far much below the MLs or within the global average. A conclusion is made that the presence of radionuclides and toxic elements in animal feed and food of animal origin does not pose a risk to the health of animals and humans. Laboratory testing is an important tool as preventive measure for feed safety, which includes monitoring of radioactivity and heavy metals presence in feedstuff from North Macedonia.

Keywords: *radionuclides, heavy metals, pig feeds, poultry feeds, lamb feeds and cattle feeds.*

THE INFLUENCE OF THE WAR IN UKRAINE ON THE IMPORT OF WHEAT, CORN AND SUNFLOWER OIL IN THE REPUBLIC OF NORTH MACEDONIA

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Abstract

Cereals are the major staple food that feeds the world, and wheat, corn and rice make up more than 40% of all consumed calories. The supply of cereals is continuously decreasing and this year will be the fifth consecutive year with an annual decline in world grain reserves, according to the International Grains Council. Additional problems include higher delivery costs, energy inflation, extreme weather conditions and labor shortages that have made food production even more difficult. The war in Ukraine is additionally raising prices, threatening to bring famine to unprecedented levels. Global food prices are at an all-time high, whereby the UN benchmark index has increased by more than 40 percent in the last two years. Food insecurity has doubled in that period, with an estimated 45 million people on the brink of starvation. This whole situation led the authors to make a more detailed analysis of the conditions. To that end, statistical sources were used, as well as views of prominent experts in the field. All processed data indicate that possible conflicts and wars such as the current one in Ukraine, significantly affect the price of these cereals not only because of the fact that they are mostly produced in Ukraine, but also because at the moment the country has a ban on export of certain cereals in order to replenish its reserves in this crisis situation of the country. At the same time, this significant impact on the price of such cereals is something that is observed today in almost every country in the world, and especially in Europe.

Keywords: *cereals, shortage, Ukraine.*

EFFICACY OF PRE-T AND POST-T (OT) HERBICIDES IN TOBACCO (*NICOTIANA TABACUM* L.) INFLUENCED BY PRECIPITATION AND SOIL TYPE

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Abstract

The field trials were conducted during two tobacco growing seasons (2018 and 2019) to estimate efficacy of PRE-T and POST-T (OT) herbicides in tobacco influenced by precipitation and soil type. Efficacy of PRE-T and POST-T (OT) herbicides varied among weed species, treatments, regions and years. Inconsistent weather patterns between two years of the study influenced the weed control. Humid May in 2018, particularly 1st WA PRE-T A (29 mm) before weed emergence, caused PRE-T herbicide leaching from soil surface which probably was the most likely reason for lower efficacy of PRE-T herbicides (<77%) compared to their application as POST-T (OT) treatment in 2018 in Prilep region. Opposite, the limited precipitation after PRE-T and POST-T (OT) application may have contributed to the poor performance of both PRE-T and POST-T (OT) herbicide treatments in Titov Veles region in 2019 (<78 and <80%, respectively) compared with 2018. Heavy precipitation directly following PRE-T and POST-T (OT) application caused tobacco injury in Prilep region in 2018 and 2019, which ranged from 8 to 25% and 7 to 22%, respectively across both treatments 7 DAHA. Injuries of pendimethalin and metolachlor were more serious. Tobacco yields for each treatment in both regions generally reflected overall weed control and crop injury.

Key words: *PRE-T (pre-transplant), POST-T (OT) (post-transplant over the top) herbicide treatment, tobacco, weeds, precipitations.*

EFFECTS OF INTERCROPPING SWEETPOTATO WITH PIGEONPEA ON PRODUCTIVITY AND SWEETPOTATO WEEVIL IN MALAWI

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Abstract

Effects of sweetpotato - pigeonpea intercrop on yield and sweetpotato weevil was evaluated on-station at Chitala, Baka and Chitedze during 2020/21 and 2021/22 growing seasons. Sweetpotato was strip-cropped with pigeonpea in 1:1 and 2:1 ridges arrangements. Treatments including sole sweetpotato (Sole SP), sweetpotato+pigeonpea, 1:1 (SP+PP-1:1); sweetpotato+pigeonpea, 2:1 (SP+PP-2:1) and within-row intercrop (SP+PP-within-row) were laid out in Randomized Complete Block Design (RCBD) replicated three times. Yield data and weevil incidence were collected. Harvesting was done at two intervals; 5 and 6 months allowing more exposure to sweetpotato weevil. Data was subjected to analysis of variance using R Programming. Partial land Equivalent Ratio (pLER) was calculated to determine sweetpotato productivity. Root yield loss due to weevil damage showed significant interaction between treatments and time of harvesting at all sites; Baka ($P=0.03$), Chitala ($P=0.03$) and Chitedze ($P=0.005$). SP+PP-row showed no weevil damage at Baka during both harvesting times and recorded least weevil damage, 2.8% at Chitala during second harvesting. While SP+PP-2:1 interestingly reduced weevil incidence by 5% at second harvesting compared to the first harvesting. pLER for sweetpotato was > 0.5 in all treatments at Chitala and Chitedze except at Baka. Sweetpotato yield was highest in Sole SP at Baka, 14.3 t/ha ($P < 0.001$) while at Chitedze, Sole SP (22 t/ha) and SP+PP-2:1 (17 t/ha) it did not differ. Sweetpotato intercrop with pigeonpea in some sites indicate yield advantage above monoculture and led to reduction of weevil incidence suggesting pigeonpea intercrop as a suitable climate smart agricultural practice for sustainable sweetpotato production.

Keywords: *Intercrop, Sweetpotato, Yield, Sweetpotato weevil, incidence.*

**RESEARCH ON THE EXTENSION OF THE VALIDITY PERIOD FOR BOILED -
SLICED MEATS, MANUFACTURED BY THE NATIONAL MANUFACTURER IN
ACCORDANCE WITH THE NORMATIVE ACTS IN FORCE**

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Abstract

Currently, the issue of food quality and safety has become a key factor in meeting consumers' requirements. Samples from the category of sliced boiled sausages were inspected: Parizer "Doctorskaia" boiled, of high quality, sliced, non-edible artificial casing, packed in a protective(modified) atmosphere, with three different manufacturing dates (three batches). The investigations were based on complex research in dynamics of physico-chemical and microbiological quality indices, to study the possibility of extending the shelf life up to 30 days at $t^{\circ}\text{C} = 0 + 6^{\circ}\text{C}$ and the relative humidity of the air max.- 75%, of meat products, manufactured according to the company standards and the technological instructions in force of the meat processor. Thus, there were obtained very good results, related to the organoleptic characteristics physicochemical and microbiological indices since they have not changed considerably over time, remaining within the normative requirements even at the end of the shelf life, not affecting the quality of the product.

Keywords: *Parizer „Doctorskaia”, normative acts, organoleptic indices, physico-chemical, microbiological.*

ENERGY DENSITY OF MEALS COMPARED TO ANTHROPOMETRIC MEASUREMENTS AMONG SUB-SAHARANS RESIDING IN THE CITY OF EL JADIDA – MOROCCO

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Abstract

Traditionally, nutritional research has focused on detailed examination of the possible roles and consequences of food components (foods and/or nutrients) on health. However, the health effects of certain foods and nutrients are generally difficult to estimate because they can be small. Moreover, nutrients and foods are consumed in a combined way and can be interactive or synergistic. Thus, an understanding of how different combinations of foods in meals and snacks are associated with diet quality and health status (such as measures of body fat) is important, for example, for the development of meal and snack recommendations for consumers. This cross-sectional study investigated how the energy density (ED) of meals and snacks is associated with overall diet quality, BMI, and waist circumference (WC), in 164 sub-Saharan adults aged 18-55 years residing in the city of EL JADIDA in Morocco. Meal ED based on contribution to energy intake showed positive associations with BMI and WC. In conclusion, in this cross-sectional study, meal ED was associated with poor diet quality. The ED of meals based on contribution to Energy Intake showed a positive association with BMI and waist circumference in both sexes, while the ED of meals based on time was positively associated with WC in men.

Keywords: *Meals, Food quality, Obesity, Energy density.*

NUTRITIONAL STATUS OF SUB-SAHARANIANS RESIDING IN THE CITY OF EL JADIDA - MOROCCO: WEIGHT IN RELATION TO SOCIO-ECONOMIC STATUS

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Abstract

Background. Onset of overweight and obesity has been previously reported as a result of population migration to western countries. **Objective.** To determine the nutritional status, weight status and their association with socioeconomic status in sub-Saharan settled in El Jadida city in a Mediterranean country Morocco. **Materials and methods.** A descriptive study was carried out in 2018 on 256 sub-Saharan migrants living in the city of El Jadida in Morocco. Information on socio-economic and socio-demographic characteristics as well as anthropometric measurements was collected. The body mass index (BMI) and abdominal obesity by measuring waist circumference (WC) and waist circumference to hip ratio (WHR) and the distribution of body fat by calculating the sum of skin folds are determined. **Results.** Analysis results indicate that height, waist circumference, hip circumference, sum of trunk skinfolds, total sum of skinfolds, and BMI increase with age. The prevalence of underweight decreases with age, overweight was 38.7% in the youngest age group (18-25 years) and reached higher values after 35 years (44.10%). In addition, the prevalence of general obesity (based on BMI) increased with age and abdominal obesity (based on WHR and WC) was more marked in sub-Saharan people aged 26 to 35 years. These results also reveal the coexistence of underweight, overweight and obesity in all age groups. The analysis revealed a significant association between several variables and obesity. Significant associations were found between age and BMI ($P=0.04$), between level of education (university) and WHR ($p=0.02$), between sex and WHR, and between sex and WC ($p=0.049$). The study revealed also that the majority of the study sample gained weight after their settling in the host country. **Conclusions.** The study data show that obesity including overweight and abdominal obesity were prevalent among sub-Saharan migrants residing in the city of El Jadida. This prevalence is associated with socio-demographic and socioeconomic factors.

Key words: *Morocco, obesity, BMI, WHR, Sub-Saharan, migrant*

EFFECT OF ALTITUDE ON PHENOLIC PROFILE AND ANTIOXIDANT ACTIVITY OF DELLAHIA PRICKLY PEAR FRUITS FROM NORTHERN MOROCCO

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Abstract

The present investigation was undertaken for the purpose of evaluating the effect of altitude on the polyphenolic profile and antioxidant activity of ‘Dellahia’ prickly pear (*Opuntia ficus-indica*) juice from Northern Morocco. At the light of this study, significant difference was noticed between samples about their total polyphenols content (TPC) ranged from 91.26 to 133.71 GAE/mg respectively for Mestassa and Boujibar sites (119 and 573m of altitude respectively). No significant difference was noticed between samples about their total flavonoids (TFC) content ranged from 1.88 to 1.91 RE/mg. Individual polyphenols were assessed by Reverse Phase High Liquid Chromatography with Diode Array Detector (RP-HPLC-DAD). The main phenolic compounds assessed in this variety of prickly pear juice were respectively Vanillic acid, Vanillin, Shikimic acid, Ascorbic acid and Quinic acid. In general, 17 phenolic compounds were identified and quantified, 11 phenolic acids and 6 flavonoids. Overall, the effect of altitude on phenolic compounds detected was not exclusive. According to 2-tailed Pearson correlation test, significance differences were only observed about Salicylic, Benzoic, Trans-Sinapic acids, Quercetine, Resorcynol, Epicatechin and samples total identified phenolic compounds. No significant difference was nor noticed between samples about their antioxidant activity for both DPPH and ABTS assays. DPPH inhibition percentage ranges from 8.85% to 19.14% while ABTS inhibition percentage ranges from 41.07% to 54.35%.

Keywords: *Opuntia ficus-indica*; ‘Dellahia’; altitude, polyphenols; flavonoids; phenolic acids ; antioxydant; DPPH; ABTS; RP-HPLC-DAD.

NUTRITIONAL QUALITIES OF STORED AFRICAN SPINACH (*AMARANTHUS SPECIES*) USING TWO VARIANTS OF NSPRI'S VEGETABLE BASKET

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Abstract

The study was aimed at determining the physicochemical composition of African spinach stored using NSPRI vegetable baskets. The baskets were constructed and wrapped in two variants: foam and jute and these variants were of large and small size. African spinach (*Amaranthus species*) was weighed and stored with different volume of water being sprayed at different time interval for a period of seven days in each of the vegetable baskets. Storage temperature and relative humidity were ranged between with Percentage weight loss were measured. Physicochemical parameters such as moisture, vitamin C, β -carotene, total chlorophyll and weight loss were evaluated using standard protocols. Data obtained were subjected to analysis of variance and treatment means compared at Duncan multiple range tests at 5% probability level. There were significant ($p < 0.05$) difference in the physicochemical parameters between variants of vegetable baskets. Storage temperature and relative humidity ranged between 28 – 33 °C and 72 – 88% respectively. There were decreasing trends in moisture, vitamin C, β -carotene, total chlorophyll and weight loss of the stored vegetables. Vegetables basket performed better than the control (ambient storage). In all, jute wrapped vegetable baskets performed better than the foam wrapped vegetable baskets. The order of performance in physical, microbial and physicochemical properties retention in the various vegetable baskets are: Jute Small Basket (JSB) (0.5L:8 hourly) > JSB (0.75L:8 hourly) > Jute Big Basket (JBB) (1.25L: 12 hourly) > JBB (1.25L:8 hourly) > JBB (1L:8 hourly) > Foam Small Basket (FSB) (0.5L:8hourly) > JSB (0.75L:12 hourly) > JBB (1L:12 hourly) > JSB (0.5L:12 hourly) > FSB (0.75L:12 hourly) > Foam Big Basket (FBB) (1L:8 hourly) > FBB (1.25L:12 hourly).

Keywords: NSPRI vegetable basket, nutritional, African Spinach, storage.

**ANTAGONISTIC POTENTIAL OF *TRICHODERMA HARZIANUM* AGAINST
FUSARIUM OXYSPORUM L. ISOLATES CAUSING FUSARIUM WILT DISEASE OF
TOMATO (*SOLANUM LYCOPERSICUM* L.)**

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Abstract

Antagonistic effect of *T. harzianum* was carried out on *Fusarium oxysporum* L. isolates of tomato variety (UC 82B) in a screen house located at the Teaching and Research Farm of Federal University of Agriculture, Makurdi during 2015 cropping season to determine their antagonistic effect on the isolates. The *F. oxysporum* isolates tested were coded as: FoAs1, FoAs2, FoAg, FoNb, FoSb, FoAm, FoAk, FoOr, FoAd and FoUAM together with an uninoculated control. The experiment was a 2 x 11 factorial laid out in Completely Randomized Design (CRD) and replicated three times. *T. harzianum* was introduced at three different times (Two days before, same time and two days after the inoculation of *F. oxysporum*). *In vitro* tests results revealed antagonistic effects of *T. harzianum* on *F. oxysporum* isolates. Growth inhibition was significantly higher ($P \leq 0.05$) when *T. harzianum* was introduced two days before inoculation of *F. oxysporum*. Interaction shows that *T. harzianum* introduced two days before inoculation of *F. oxysporum* gave better inhibition of all the *Fusarium* isolates tested except isolates FoAd and FoAg compared with when the antagonist was introduced at the same time and when it was introduced two days after inoculation of *F. oxysporum*. Also, *T. harzianum* ($P \leq 0.05$) totally inhibited the growth of isolates FoAg, FoAs1, FoNb, FoOr and FoUAM but not those of FoAd, FoAk, FoAm, FoAs2 and FoSb. It is therefore recommended that *T. harzianum* be used in the management of fusarium wilt disease of tomato

Key Words: *Antagonistic; Inhibition; Fusarium oxysporum; Isolates; T. harzianum*

COMPATIBILITY AND SYNERGISTIC INTERACTIONS OF FUNGI, METARHIZIUM ANISOPLIAE, AND INSECTICIDE COMBINATIONS AGAINST CABBAGE APHID AND COTTON APHID SPECIES

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Abstract

Aphids are major pests affecting cereals, vegetables, fruit, forestry and horticultural produce. A multimodal approach may be an effective route to controlling this prolific pest. We assessed the individual and combined effect of eight insecticides and the entomopathogenic fungi, *Metarhizium anisopliae* (Metschin.) against cabbage aphid and cotton aphid species under laboratory conditions. Six of the insecticides tested were found to be highly compatible (flonicamid, imidacloprid, nitenpyram, dinotefuran, pyriproxyfen and spirotetramat), showing positive integration with the fungus and were selected for bioassays. The combination mixtures (1:1 ratio of *M. anisopliae*: insecticide) were significantly more toxic to aphid species than individual treatments. Maximum mortality of cotton aphid (91.68%) and cabbage aphid (88.36%) recorded with combination of flonicamid and *M. anisopliae* (2.4×10^6 cfu/ml) 72 h after application. While minimum mortality 17.08% and 16.66% was observed with the individual treatment of *M. anisopliae* (2.4×10^6 cfu/ml) against cotton aphid and cabbage aphid respectively. Our study indicates that *M. anisopliae* has the potential to control cotton aphid and cabbage aphid within short period of time when combined with insecticides. The combined insecticide *M. anisopliae* was consistently more toxic than individual treatments. The present study utilized co-toxicity coefficients and synergy factors to calculate the efficacies of different insecticides + *M. anisopliae* formulations. The toxicity of insecticides, based on their L C50 and L C90 values increased when mixed with *M. anisopliae*. The insecticides revealed toxicity consistent with their compatibility with *M. anisopliae*, ranking for efficacy exactly as they did for compatibility. In addition, the synergy factor (SF) and co-toxicity coefficient (CTC) values indicated synergistic interactions at different time intervals. The high values of co-toxicity coefficients, which were accompanied by insect mortalities > 90% for some treatments, illustrate the effectiveness of this dual-attack method of insect pest control. The synergistic efficacy revealed the potential of fungus-insecticide integration against sucking insect pests.

Key Words: *M. anisopliae*, Insecticides, Sucking insect pests, Aphids, Toxicity.

COMPATIBILITY AND SYNERGISTIC INTERACTIONS OF FUNGI, METARHIZIUM ANISOPLIAE, AND INSECTICIDE COMBINATIONS AGAINST TWO APHID SPECIES

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Abstract

Aphids are damaging many crops. We assessed eight insecticides and *Metarhizium anisopliae* (Metschin.) against cabbage aphid and cotton aphid species under laboratory conditions. Six insecticides (flonicamid, imidacloprid, nitenpyram, dinotefuran, pyriproxyfen, and spirotetramat) highly compatible with fungus were selected for bioassays. The combination mixtures (1:1 ratio of *M. anisopliae*: insecticide) were significantly more toxic to aphid species than individual treatments. Maximum mortality of cotton aphid (91.68%) and cabbage aphid (88.36%) was recorded with combination of flonicamid and *M. anisopliae* (2.4×10^6 cfu/ml) 72h after application. While minimum mortality 17.08% and 16.66% was observed with the individual treatment of *M. anisopliae* (2.4×10^6 cfu/ml) against cotton aphid and cabbage aphid, respectively. Therefore, *M. anisopliae* has potential to control aphid species more effectively when combined with insecticides. The combined insecticide and *M. anisopliae* was consistently more toxic than individual treatments. Current study utilized co-toxicity coefficients and synergy factors to calculate efficacies of different insecticides + *M. anisopliae*. The toxicity of insecticides, based on their LC50 and LC90 values increased when mixed with *M. anisopliae*. The insecticides revealed toxicity consistent with their compatibility with *M. anisopliae*, ranking for efficacy exactly as they did for compatibility. The synergy factor (SF) and co-toxicity coefficient (CTC) values indicated synergistic interactions at different time intervals. The high values of co-toxicity coefficients, which were accompanied by insect mortalities >90% for some treatments, illustrate the effectiveness of this dual-attack method of insect pest control. The synergistic efficacy revealed the potential of fungus-insecticide integration against sucking insect pests.

Key words: *M. anisopliae*, Insecticides, Sucking insect pests, Aphids, Toxicity.

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. expansum*, 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. expansum* 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.

Keywords: *Biological control, Fusarium wilt, Tomato, Penicillium spp.*

EVALUATION OF FOUR DIFFERENT OILS AGAINST TWO-SPOTTED SPIDER MITES (TETRANYCHIDAE: ACARI) AND THRIPS (THRIPIDAE: THYSANOPTERA)

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Abstract

Mites are microscopic creatures placed in class Arachnida with more than 50,000 described species. Mites are diverse and ecologically successful organisms of the phylum Arthropoda. Families of phytophagous mites like Tetranychidae, Tenuipalpidae, and Eriophyidae are important regarding their attack on plants causing damage and economic loss to plants. Due to an increase in pesticide resistance, there is a need to develop new biological tactics for mite control is crucial. The present study was conducted to study the efficacy of four different plant oils against two-spotted spider mites *Tetranychus* species (Tetranychidae: Acari) and thrips (Thripidae). Plant oils like *Cymbopogon schoenanthus*, *Zingiber officinale*, *Allium sativum*, and *Coriandrum sativum* are considered the most efficient source of controlling two-spotted spider mites and thrips due to their non-lethal effects. Garlic and lemon grass are also considered as most efficient bio-pesticides around the world. To propose an alternative to chemical control, the mortality assessment of plant oils was carried out under laboratory conditions against mites and thrips. Five treatments, including a control having four replications were used. Different concentrations of 2%, 1.5%, 1%, and 0.5% of each oil was used and mortality of mites and thrips was observed after applying four plant oils. Lemongrass showed the highest mortality rate in mites and thrips, which increases with the increase in time. Mortality was maximum in the case of thrips and mites at 71% and 62.5%, respectively. Garlic was second on the mortality list for both mites and thrips at 61.5% and 43.5%, respectively. Ginger and coriander also proved effective against mites and thrips but showed less mortality than the other two plant oils. The results revealed that the above four plant essential oils could be used as an effective tool against mites (Tetranychidae) and thrips (Thripidae).

Keywords: *Essential oils, Tetranychidae, Thripidae, mortality effect*

**INFESTATION, MOLECULAR IDENTIFICATION AND SEQUENCE ANALYSIS OF
YELLOW PEACH MOTH, *CONOGETHES PUNCTIFERALIS* (GUENÉE)
(LEPIDOPTERA: PYRALIDAE) INFESTING GUAVA IN PUNJAB, PAKISTAN**

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Abstract

Yellow peach Moth infested guava fruits were collected from Guava orchards and placed in Plastic Jars for adult emergence. Molecular identification and sequence analysis of Yellow Peach Moth *Dichocrocis punctiferalis* (Lepidoptera: Pyralidae) was done through PCR. In PCR, two mitochondrial cytochrome oxidase I (COI) gene based primers LCO-1490/ HCO-2198 and C1J2195/ TL2N3014 were used for identification of *D. punctiferalis* collected from guava orchards in Punjab, Pakistan. Sequence analysis was also complemented to differentiate *D. punctiferalis* identified from other countries of the world. The PCR bands obtained in gel electrophoresis amplified PCR fragments of 710bp. The sequencing analysis with sequences submitted at NCBI database revealed that *D. punctiferalis* have 99-100% similarity with same species and 90-94% similarity from other species of same genus and members of same family. This is the first report of infestation, molecular identification of yellow peach Moth, *D. punctiferalis* infesting Guava from Punjab, Pakistan.

Keywords: *D. punctiferalis*/*C. punctiferalis*; Peach Yellow Moth; DNA barcoding; Guava pest.

AMELIORATIVE EFFECTS OF *CALOTROPIS PROCERA* AMENDED SOIL ON FUSARIUM WILT DISEASE, ENHANCEMENT IN GROWTH AND NUTRITIONAL QUALITIES IN PEA

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Abstract

Commercial fungicides are effective to control fungal pathogens in agriculture, but all are associated with ill effects. In multi-years pot and field trials, we investigated the disease suppressing efficacy of *Calotropis procera* against *Fusarium oxysporum*, the causal agent of wilt disease in pea (*Pisum sativum*). Five treatments were made in pot assays as T₁ (negative control), T₂ (positive control), T₃ (Dead inoculum), T₄ (0.75%), T₅ (1.5%), of *C. procera* with pathogen inoculum, respectively, while, three treatments in field assays were, T₁ (negative control), T₂ (positive control), T₃ (400 g/plot of *C. procera*). *C. procera* reduced negative effects of disease and resulted in 41.1 and 52.8% increase in shoot dry weight besides 94.8 and 84% improvement in root dry weight of pea plant, during years 1 & 2, respectively, in pot bioassays. Similarly, *C. procera* amendment increased 25.5% and 17.4% green pod yield under field conditions, in years 1 & 2, respectively. Incorporation of *C. procera* mulches in pea also improved proteins up to 64% and carbohydrates content up to 37.2%. Moreover, iron, calcium and potassium also showed an increased concentration in response to *C. procera* addition. The present study concludes that *C. procera* mulches can be used to manage *Fusarium* wilt disease and to improve nutritional traits of pea.

Keywords: *Nutritional, Calotropis, Fusarium, Pisum, Wilt.*

MITIGATION OF SALINITY INDUCED TOXICITY THROUGH MODULATIONS IN BIOCHEMICAL ATTRIBUTES BY SALICYLIC ACID IN MAIZE (*ZEA MAYS* L.)

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Abstract

Salt stress is one of the crucial factor which decreases the production of crops in Pakistan. Salicylic acid (SA) is an active plant hormone, known for mediating biochemical and defense processes against salinity stress. To examine the effect of exogenously applied SA (0.5 mM) as foliar spray to mitigate salinity induced effects on two varieties (Sadaf and Sahiwal gold) of *Zea mays* L. Plants were grown in sand filled plastic pots subjected to saline condition (0 mM and 120 mM NaCl) supplied with full-strength Hoagland's nutrient solution. Biochemical studies indicated increase in root and shoot length, fresh and dry weight under combined effect of salinity and SA treatment. This increase is linked with enhanced activities of antioxidant enzymes (CAT, POD, SOD), non-enzymatic antioxidant (carotenoids, total phenolics), enhanced accumulation of proline, amino acid, total proteins, flavonoids, plant pigments (chlorophyll *a* and *b*, total chlorophyll, chlorophyll *a/b* and anthocyanin) shoot and root K⁺ and Ca²⁺ ion contents in maize plants by foliar spray of SA. Whereas, foliar spray of SA significantly reduced accumulation of H₂O₂ and MDA and Na⁺ and Cl⁻ ion contents under salinity stress condition. Overall, SA application was effective in the alleviation of salt-induced toxic effects on maize by regulation of antioxidants, accumulation of secondary metabolites and nutrient management. Therefore, the field use of SA (0.5 mM) as foliar spray is recommended to improve maize production in saline soils.

Keywords: *Salicylic acid, Maize, Antioxidants, Metabolites, NaCl*

PLANT DIVERSITY AND ECOSYSTEM SERVICES OF THE CHOLISTAN DESERT, PAKISTAN

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Abstract

The aim of this study was to record ecosystem services of the Cholistan Desert rangeland, which is one of the largest deserts of the Pakistan located in the Southern part of Punjab province. This study was undertaken to document the indigenous use of plants of this aridland by using a semi-structured questionnaire from the local communities, herbalists (Hakeems) and other various stakeholders. During the survey, a total of 141 plants distributed across 105 genera and 43 families are recorded which are being used by the local inhabitants to fulfil their various needs. With reference to different habits of plants, eight life forms of the flora identified in which herbs were dominant with 64 plant species (40.76%), followed by trees (28 spp., 17.83%), grasses (24 spp., 15.29%), shrubs (23 spp., 14.65%). This ecosystem fulfills nine different needs of the local communities and plants are found with maximum fodder value to feed their livestock (122 spp., 28.37%), followed by medicinal (78 spp., 18.37%), others (76 spp., 17.67%), fuelwood source (65 spp., 15.12%), vegetable cooking (26 spp., 6.05%), wild fruits (20 spp., 4.65%), ethno-veterinary (17 spp., 3.95%), etc. According to the use value index (UVI) of individual species, *Azadirachta indica*, *Cordia myxa* and *Prosopis cineraria* are top ranked species which are fulfilling eight use classes, followed by *Capparis decidua*, *Melia azedarach*, *Acacia nilotica*, *Morus alba* and *Ziziphus mauritiana*. The natives of Cholistan desert have good knowledge of medicinal plants and are using 73 plant species to treat 65 different ailments/diseases. Based on the results, it can be concluded that the area is rich in plant diversity along with rich heritage of utilization. So efforts are required to conserve some of the remnant vegetation for their long-term preservation and sustainable utilization by the future generation.

Keywords: *Cholistan desert, Plant Biodiversity, Ecosystem services, Endemic flora, Livelihood.*

ANALYSIS OF HEAVY METAL CONTENT IN FOOD CROPS FROM A TYPICAL MINING CITY IN PERU

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Abstract

Heavy metal contamination is of worldwide concern due to food safety issues and human health risk through the food chain. This study was carried out during 2021 in a copper mining area in the South West Peru (Moquegua), where knowledge of the contamination of locally produced foodstuffs with heavy metals has not yet been established. A total of 135 samples of vegetables, olives and cheese produce were purchased from several local suppliers and farmers' markets. The content of cadmium, lead, and arsenic was measured using atomic absorption spectrophotometry and inductively coupled plasma-mass spectrometer (ICP-MS). In addition, structured questionnaires were administered to smallholder farmers to collect data on factors that can influence the levels of heavy metals in the samples. Descriptive statistics and cluster analysis were used in analyzing the data. Results showed that staple foods such as arracacha, carrots, broccoli, spinach and lettuce are the major contributors to dietary cadmium intake. This is more important because plant foods with a mean cadmium concentration of ≤ 0.03 mg/kg, are the major contributors to dietary cadmium intake. Among these foods, lead content in broccoli exceeded FAO/WHO recommended values (0.1 mg/kg). Irrigation and marketing systems are two important aspects of food quality assurance. The levels of metals found in this study are compared with those reported for similar food crops from some other parts of the world. Hence, the control of human exposure to metals to prevent adverse health effects is still an important public health issue.

Keywords: *Heavy metals, ICP-MS, Atomic absorption spectroscopy, Local foods, Small-family farm.*

THE IMPACT OF CADMIUM STRESS ON STEROID AND TRITERPENOID METABOLISM IN *CALENDULA OFFICINALIS* PLANTS

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Abstract

Most heavy metals are nonessential for plants and negatively impact their growth and development. Cadmium is considered highly phytotoxic heavy metal, causing stunted growth and chlorosis; and leading to growth inhibition and necrosis at higher concentrations. The present study investigated the influence of Cd stress on the steroid and triterpenoid metabolism in *Calendula officinalis* L. plants (aerial parts, i.e., shoots, and roots) by a targeted GC-MS metabolomic approach. Plants were cultivated in Cd-contaminated soil (5 mg Cd/kg d.w.). *C. officinalis* has ornamental and medicinal value, moreover, it seems to be a promising candidate for cadmium phytoremediation. The observed effects included the changes in content and composition of steroids and triterpenoids, particularly the proportions among individual sterols, their ester and glycoside conjugates. Cd stress significantly altered the contents of steroids, however, differently in roots and shoots. The total sterol content increased in roots by 30%, whereas it decreased in shoots by 15%; moreover, these effects were inversely correlated with Cd-induced growth suppression. The shoots did not display the symptoms of growth reduction; on the contrary, both the biomass and the height of shoots of Cd-treated plants were greater (by 32% and 26%, respectively) than those of untreated plants; such phenomenon has been reported in other studies and termed “hormesis”. The symptoms of the competition between general metabolites (sterols) and specialized metabolites (triterpenoids) were also observed, i.e., the increase of the sterol biosynthesis parallel to the decrease of the triterpenoid content in roots, and the inverse phenomenon in shoots.

Keywords: *abiotic stress, cadmium, Calendula officinalis, steroids, triterpenoids.*

CHANGES OF SEVERAL METABOLIC PARAMETERS OF SOYA INOCULATED WITH PHYTOPATHOGENS AT APPLICATION NANOCHELATES

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Abstract

In greenhouse experiments changes in several metabolic parameters soybeans plants after inoculation by *P. savastanoi* pv. *glycinea* 9190, *X. axonopodis* pv. *glycines* 9192, BCMV, *A. laidlawii* on background pre-treatment by nanochelates (NHs) of V, Ge, Cu, Mo have been shown. The phenolic compounds content increased in leaves at inoculation by phytopathogens on background pre-treatment by NHs and without it. The content of H₂O₂ in leaves increased in variants: BCMV (+VNHs, GeNHs, CuNHs), 9192 (+VNHs, CuNHs), 9190 (+GeNHs, CuNHs), *A. laidlawii*+MoNHs. But it decreased in the variants: BCMV + MoNHs, *A. laidlawii* + VNHs, 9190 + VNHs, 9192 (+ GeNHs, CuNHs) compared to controls. The peroxidase activity increased in variants: *A. laidlawii*, 9190, GeNHs + 9190, GeNHs + 9192, CuNHs, CuNHs (+ phytoplasmas, 9192), MoNHs (+ BCMV, phytoplasmas, 9190, 9192) with decreased catalase activity. The content of ABA in the leaves increased in variants: 9190, 9192 (+ VNHs, CuNHs), GeNHs + 9190, but the IAA content reduced. However, on variants MoNHs (+9190, 9192), GeNHs + 9192, *A. laidlawii*, *A. laidlawii* (+ GeNHs, CuNHs, MoNHs) the content of both phytohormones was decreased. The content of IAA and ABA in BCMV-infected leaves without treatment was increased, but on background of NHs – it decreased significantly. The F_v/F_m-value increased in almost all variants, except for CuNHs + BCMV. The photosynthetic rate (R_{Fd}-value) at inoculation plants with viral, bacterial and phytoplasmas pathogens on background treatment of MoNHs; bacterial strain on background of pre-treatment of GeNHs; phytoplasmas on background of VNHs have been increased. Thus, pre-treatment by nanochelates had regulatory effect on soybean plant metabolism helping increase its resistance to phytopathogens was shown. Thus, pre-treatment by nanochelates had regulatory effect on soybean plant metabolism but the pre-treatment of MoNHs was more effectiveness thanks not only intensification resistance against pathogens but and the assimilation of CO₂ increased.

Keywords: *Xantomonas axonopodis* pv. *glycines*, *Pseudomonas savastanoi* pv. *glycinea*, *Acholeplasma laidlawii* var. *granulum*, BCMV, nanochelates

ACRYLAMIDE CONTENT IN WHEAT-FLOUR COOKIES ENRICHED WITH THE SELECTED WILD-GROWN FRUITS

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Abstract

Confectionery products, which are popular among consumers, might also be a source of some potentially toxic compounds, e.g. acrylamide, which is formed upon heating and in low moisture. The study aims at evaluating the impact of the selected wild grown fruits (elderberry, sea-buckthorn, rowan, choke berry and hawthorn) added to the wheat – flour cookies formulation on the content of acrylamide. Seven types of wheat cookies were tested: (1) wheat- flour cookies without an addition of lyophilised fruits used as a control (2) wheat-flour cookies with 5% of sea-buckthorn (*Hippophae rhamnoides* L.); (3) cookies with 5% of elderberry (*Sambucus nigra* L.); (4) cookies with 5% of hawthorn (*Crataegus* L.); (5) cookies with 5% of rowan (*Sorbus aucuparia* L.); (6) cookies with 5% of choke berry (*Aronia melanocarpa*); (7) cookies with 5% of wild rose (*Rosa canina* L.). Fresh fruits were gathered, frozen and freeze dried with liophiliser. Then they were minced and used in that form as a bakery ingredient. The content analysis of acrylamide was performed using a Knauer chromatograph with a UV-VIS detector. The acrylamide content of all fruit-enriched cookies was in the range of 81.98-524.96 µg/kg d.m., being the lowest in chokeberry cookies and highest in hawthorn enriched cookies ($p < 0.05$). Control cookies were characterized by significantly highest acrylamide content (1290.77 µg/kg d.m.) ($p < 0.05$). The results of this study indicated that cookies enriched with the wild-grown fruits might constitute an efficient tool in reducing acrylamide content in snack food.

Keywords: *Acrylamide, Wheat flour, Cookies, Wild-grown fruits.*

ESTIMATION OF OXALATES INTAKE WITH FOOD RATIONS OF STUDENTS

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Abstract

There are many anti-nutritional substances in food that limit the use of nutrients necessary for the proper functioning of the human body. There are oxalates among them, which reduce the proper use of minerals from food, mainly calcium and magnesium. They also show a toxic effect. Excess oxalic acid and its insoluble salts can cause many diseases. The aim of the study was to estimate the oxalates intake in students' food rations and to identify food products that provided the highest amounts of these compounds to the tested diets. A questionnaire was created and used in the research. The included questions concerned the diet from the last 3 days. The research was performed on a group of 20 students aged 20 to 25 years. 50% of them were female and 50% male. The research has shown that the mean daily oxalates intake with the diet of the surveyed students amounted to 144.60 mg. Besides, tea made the greatest contribution to providing oxalates in students' diets (27.8%). The other sources of oxalates were: fruit (17.9%), coffee (17.7%), vegetables (17.5%), cereal products (12.9%), beer/wine (3.0%), chocolate and chocolate products (1.9%), and other products (1.3%). In conclusion, the mean daily oxalates intake with the diet of the surveyed students was relatively high. However, it did not exceed the Acceptable Daily Intake (ADI) of the oxalates, which should not exceed 250 mg per day. Moreover, important sources of oxalates in the diets of the surveyed students were: tea, fruit, coffee, vegetables, and cereal products.

Keywords: *oxalates intake, food rations, surveyed students*

21-DAY-OLD YOUNG SHOOTS OF SELECTED BRASSICA VEGETABLES AS AN EXCELLENT SOURCE OF MINERALS, PROTEIN AND DIETARY FIBRE

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Abstract

Brassica vegetables are abundant in minerals, the presence of which is vital to maintain certain, crucial to life, physicochemical processes. These inorganic substances occur in all body tissues and fluids. In vegetables, the content of trace minerals may vary and depends on various factors: inherent (variety, maturity, genetics, and age) and environmental (soils, geographical locations, season, water source and fertilizers). Sprouts and young shoots constitute an emerging class of fresh functional foods with an immense potential for enhancing human diet and addressing nutritional deficiencies due to their potent phytochemical content and their adaptability to large-scale commercial as well as localized small-scale or even domestic production. The aim of this study was therefore to examine in 21-day young shoots of white and red headed cabbage for the contents of dry mass, total protein, crude fat, ash, dietary fibre, digestible carbohydrates and selected major essential minerals (Na, K, Ca, Mg) and trace elements (Mn, Fe, Zn and Cu). The results showed that young shoots of red cabbage included more minerals and total protein, so it can be stated that they were a better source of these nutrients in comparison to young shoots of white head cabbage. The findings also suggested that young shoots of white and red head cabbage could be an attractive source of some nutritive components. For example the measured Ca content in young shoots of both white and red cabbage was 230 mg/100 g of fresh weight and this value is on average almost four times higher compared to the literature data for mature white cabbage and almost five times higher than data for red cabbage at full maturity. For Mg, its content in young shoots of white and red cabbage was on average twice in comparison to data for cabbage at full maturity.

Keywords: *Basic composition, Major essential minerals and trace elements content, Young shoots, White head cabbage, Red head cabbage.*

HEAVY METALS CONTENT IN THE FRUITS AND LEAVES OF RASPBERRY (*RUBUS IDAEUS* L.) FROM ORGANIC, CONVENTIONAL AND WILD CROP IN POLAND

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Abstract

Natural and anthropogenic activities contribute to the greatest extent to the accumulation of heavy metals in the environment. Food production in contaminated areas leads to the accumulation of hazardous compounds in vegetables and fruits and, consequently, to a negative impact on food safety and human health, as well as on the quality and growth of crops. The aim of the study was to compare the content of heavy metals, i.e. arsenic, lead, cadmium and aluminium, in fruits and leaves of *Rubus idaeus* L. raspberry from different crops: organic, conventional and wild. Determination of selected harmful elements (arsenic, cadmium, lead, aluminium) was carried out using the ICP-MS QQQ (Triple Quadrupol) spectrometer model: iCAP TQ ICP-MS. The statistical analysis shows that significantly less ($p \leq 0.05$) arsenic was found in conventionally grown raspberry leaves, compared to organic and wild raspberry leaves and fruits. Significantly more cadmium was found in the leaves and fruits of wild raspberries, compared to the leaves and fruits of conventional and organic raspberries. The leaves of the ecologically grown raspberry contained significantly more lead than the leaves of the conventionally grown raspberry and significantly less lead than the leaves of the wild raspberry. As for the content of this element in raspberry fruit, the type of cultivation did not significantly affect its content. Conventional raspberry leaves contained significantly more aluminum than leaves from other crops. On the other hand, organically grown raspberries contained significantly more aluminum than conventional and wild-grown raspberries. The obtained results indicate that among the tested fruits and leaves, conventional raspberry was the most favorable, as opposed to the fruit and leaves of wild raspberry.

Keywords: *Arsenic, Cadmium, Lead, Aluminium, Metals*

THE FUNGICIDAL ACTIVITY OF THE ANTARCTIC *BACILLUS* SP. STRAIN

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Abstract

One of the main trends of agrotechnology and biotechnology is the search for alternative solutions to synthetic fungicides. Currently existing biosolutions are based on mesophilic strains inactive at low temperatures. The bioprospection of cold-active strains is now a very desirable path in the development of biotechnology due to the possibility of using this application niche, especially in the early periods of plant vegetation. In this work, the fungicidal properties of the cold-active Antarctic *Bacillus* sp. ANT_WA51 are presented. Nine plant pathogenic fungi, i.e.: *Thamnidium elegans* WA18081, *Aspergillus niger* WA50716, *Aspergillus ochraceus* WA72081, *Penicillium expansum* WA72083, *Botrytis cinerea* WA72082, *Alternaria* sp. WA67128, *Cladosporium* sp. WA72809, *Fusarium tricinctum* WA67200, and *Fusarium sporotrichioides* WA67190 were obtained from the Herbarium Universitatis Varsoviensis, Botanic Garden, University of Warsaw (WABG) (Poland). The antifungal activity of bacteria was assessed against all investigated plant pathogenic fungi on potato dextrose agar (PDA) medium. Fungi were grown on PDA medium for 7 days at 20°C. After incubation, 1 cm plugs of mycelia of actively growing fungi were placed in the centers of new PDA plates. Bacteria were spot-inoculated in sterile cylinders using 10 µL of culture. Fungi along with *Bacillus* sp. ANT_WA51 were cultured for 7 days at 20°C. As a result of the experiment, the tested strain exhibited fungistatic activity and was effective against *B. cinerea* WA72082, *Alternaria* sp. WA67128, *Cladosporium* sp. WA72809 and *F. tricinctum* WA67200.

Keywords: *Antarctica, Bacillus, cold-active, fungicide.*

RESPONSE OF THUNBERG'S BARBERRY TO SALINITY STRESS CAUSED BY HALITE AND CARNALITE

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Abstract

The intensive city development is the main reason for the changes in street greenery near communication routes. Shrubs intended for planting in complex urban conditions should show high tolerance to adverse environmental factors, including high salinity resulting from treatments carried out in winter. This study aimed at the salinity effects on Thunberg's barberry caused by mine salts: halite (NaCl) and carnallite ($\text{KCl} \cdot \text{MgCl}_2 \cdot 6\text{H}_2\text{O}$) due to road de-icing processes. The research was carried out on plants growing in the controlled conditions of the phytotron chamber. Physiological parameters were evaluated after salt dosages of 50, and 100 g m⁻² were applied twice and four times in weekly intervals. Road salt (NaCl) caused damage to the cytoplasmic membranes and affected the content of chloroplast pigments to a greater extent than carnallite. Both salts stimulated anthocyanin accumulation, but with carnallite, the effect was more significant, indicating these metabolites' participation in the defence reaction. Mine salts caused a reduction of fresh mass and shrubs growing intensity. Therefore, only soil samples (without leaves) were collected for chemical analysis at the end of the experiment. The applied doses of carnallite caused a more significant increase in the specific conductivity of the substrates than the corresponding doses of road salt. Visual assessment of barberry and photographic documentation were carried out ongoing. Using other mine salts instead of halite for de-icing green spaces is recommended.

Keywords: *Barberry, Mine salt, Photosynthetic pigments, Anthocyanins, Membrane integrity.*

INDIGENOUS YEASTS FROM WINE WORT WITH ANTIFUNGAL POTENTIAL

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Abstract

The study of microorganisms involved in the spontaneous fermentation of food or beverages offers the possibility of isolating new strains with high biotechnological potential presenting distinct metabolic properties specific to various ecological niches. Two yeast strains from spontaneously fermented wine wort from Ilfov County (Romania) for biocontrol and food protection were identified by conventional taxonomy tests, PCR-RFLP and sequencing of the ITS1-5,8S-ITS2 rDNA region. Growth in presence of thermal, ionic and osmotic stress conditions was determined. Antifungal activity was evaluated by co-cultivation with *Aspergillus*, *Rhizoctonia*, and *Botrytis* strains (Sabouraud medium, seven days, 28°). The percentage of inhibition of mycelial growth was determined for *Aspergillus flavus* and *Aspergillus ochraceus* strains. Thin layer chromatography was used for qualitative determination of *A. ochraceus* mycotoxigenic compounds inhibition. Improvement of antifungal activity was evaluated in presence of 1 or 2% sodium bicarbonate. The isolated yeast strains were taxonomically identified as belonging to *Metschnikowia pulcherrima* and *Hanseniaspora uvarum*. Resistance profile assays showed that both strains are able to develop under the tested stress conditions. The strains affected the mycelial growth of *Botrytis cinerea*, *Aspergillus flavus*, *Aspergillus ochraceus* or *Rhizoctonia solani* from contaminated foods, with an inhibition index up to 80.95% against mycotoxigenic *A. flavus* and *A. ochraceus* (producing ochratoxin A). Sodium bicarbonate enhanced the antifungal activity of both yeast strains, inhibiting spore germination and germ tube growth of *Aspergillus* strains. The newly characterized *M. pulcherrima* and *H. uvarum* yeast strains showed high biocontrol abilities, representing an important basis for future applications in food protection.

Keywords: *Metschnikowia pulcherrima*, *Hanseniaspora uvarum*, antifungal activity, food protection, phytopatogens .

BROWN MARMORATED STINK BUG (HALYOMORPHA HALYS) AS A NEW PEST IN BLUEBERRIES ORCHARDS, MONITORING AND CONTROL MEASURES

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Abstract

The fruits of high-bush cultivated blueberries are becoming an increasingly sought-after item on the fruit market, which is why there is a need to increase growing areas, and at the same time to provide high-quality yields. Many insects might endanger production, which indicates the need for well-defined and precise monitoring in orchards. The presence of an invasive Brown Marmorated Stink Bug, *Halyomorpha halys* Stål (Hemiptera: Pentatomidae) was found in hazelnut orchards in the area of Šabac (Serbia) in 2020, in which kernels damage were also recorded. Therefore, in 2021 monitoring was conducted in two blueberry plantations, using pheromone dead-in traps (AgBio with Tréce lures). Traps recorded adults of both sexes and nymphs that hatched nearby, while eggs and all developmental stages in places away from the trap were inspected visually, on a weekly basis. In addition to the most abundant species, *H. halys* other heteropterans were present such as *Gonocerus acuteangulus*, *Nezara viridula*, and *Graphosoma lineatum* whose presence was detected by visual inspection in the orchards. The pheromone used attracted a large number of specimens, which is why the number of *H. halys* specimens was the largest in the point closest to the trap, while in the farthest place from the trap almost no specimen was recorded. The results showed that *H. halys* found suitable conditions for its development in the blueberry orchards, in the Šabac, as evidenced by recorded eggs. Several natural insecticides have been tested, among which azadiractin, pyrethrin, and aspanger clay have shown the best efficacy.

Keywords: *brown marmorated stink bug, Halyomorpha halys, blueberries, monitoring, natural insecticides*

APPLICATION OF MODIFIED QUECHERS METHOD FOR THE DETERMINATION OF NEW GENERATION PESTICIDES IN BLACKBERRIES

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Abstract

Blackberries (*Rubus fruticosus*) are fruits that contain vitamins, minerals, amino acids and essential dietary fiber. Blackberries are also considered a rich source of phenolic acids and anthocyanins, which play an important role in the prevention of chronic diseases. Unfortunately, pesticide residues in fruit products are becoming a major health problem for human consumption. However, simultaneous determination of pesticides in fruit is a challenging task due to the complex fruit matrix and the dynamic increase of new pesticides being introduced to the market. In this research, a modified QuEChERS sample preparation method was developed to simultaneously determine seven new generation pesticides, namely cyprodinil, pyrimethanil, chlorothalonil, folpet, fluopyram, pyriproxyfen and fenhexamid. Vortex-assisted solid-phase extraction and an additional clean-up step using 500 mg of primary secondary amine (PSA) were applied successfully. PSA was used to eliminate fatty acids, organic acids, and polar pigments and sugars. Calibration curve linearity was evaluated by spiking blank blackberries samples with the concentration levels: 0.01, 0.02, 0.03, 0.05 and 0.1 mg/kg. The linearity of the analytical response across the studied range of concentrations was excellent, obtaining correlation coefficients higher than 0.99. Matrix-matched calibration was established in order to compensate possible pesticide losses and the impact of matrix effects. The average recovery for all pesticides quantified by gas chromatography mass spectrometry (GC/MS) at 0.01 and 0.02 mg/kg fortifying levels were from 86 % to 109% (RSD < 8.2%). The fungicide cyprodinil was found in 8% of samples but the determined levels were in the range 0.050-0.105 mg/kg and below the maximum residue level established by Reg. (EU) 2021/1810. Other tested pesticides were below the quantification limit.

Keywords: *Pesticides, Blackberries, GC/MS, Extraction.*

APPLICATION OF INSECTICIDES IN THE CONTROL OF COLORADO POTATO BEETLE (*LEPTINOTARSA DECEMLINEATA* SAY)

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Abstract

Colorado potato beetle (CPB) (*Leptinotarsa decemlineata* Say) is one of the most dangerous pests in potato fields. Nowadays it is worldwide present. *L. decemlineata* is an oligophagous due to its feeding on leaves of different plants such as potato, eggplant, paprika, tobacco, as well as many weeds from *Solanaceae* family. Larvae are much more harmful than adult insects. Successful potato cultivation in the world and our climate is possible only with efficient chemical crop protection against CPB. It is well known that this insect in its way, during a relatively short time, manages to develop resistance to almost every insecticide used so far. Therefore, this study aimed to evaluate the biological efficacy of plant protection products (PPP) based on acetamiprid (200 g/kg) and spinosad (240 g/l) in the control of adults, eggs, and larvae (L1-L3, and L4 larval stages) of CPB, and to determine whether there is a significant difference in efficacy of mentioned insecticides. Field trials were conducted according to standard EPPO methods at two localities in the Republic of Serbia (Šajkaš and Mošorin, region of Vojvodina) in 2021, in the potato crops of Bellarosa and Rivera varieties. The insecticidal treatments were performed using back-sprayer “Solo” 473 P, with water consumption of 400 l/ha. According to the obtained results, it can be concluded that two days after the application of PPPs based on acetamiprid (200 g/kg) and spinosad (240 g/l), the number of L1-L3 larvae was significantly lower than the control, and the efficacy ranged from 95.6 to 100% at both localities. Larvae in stage L4, adults, and eggs were registered in very low numbers in all variants. After seven days from the insecticides application, efficacy in L1-L3 larval stages ranged from 71,3 to 100%, and for the L4 stage from 83,8 to 100%, depending on the applied PPP. Adult insects and egg clusters were noticed in negligible numbers. The high effectiveness of PPPs based on acetamiprid and spinosad, at both localities, indicates the sensitivity of *L. decemlineata* populations to the mentioned insecticides and the possibility of their successful use in the control of this pest in our agroecological conditions.

Key words: *Leptinotarsa decemlineata*, potato, acetamiprid, spinosad

EFFECTS OF INSECTICIDES APPLICATION, FUNGAL AND ECB INFECTION ON CAROTENOIDS CONTENTS IN MAIZE LEAVES

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Abstract

There are two types of carotenoids in plants which can be further categorized into two classes: the unoxxygenated carotenoids (β -carotene and lycopene) and the oxygenated xanthophylls (lutein and zeaxanthin). As effective antioxidants carotenoids have an important role in protecting plants from oxidative damage caused by abiotic and biotic stresses. Insecticide application is necessary in maize production, due to high levels of ECB pest pressure causing maize yield losses. The aim of this study was to evaluate effects of two insecticides (deltametrin and chlorantraniliprole), ECB and fungal infection on carotenoids contents in maize leaves of two hybrids. Leaves were collected in reproductive stage two weeks after foliar insecticide applications, three weeks after egg mass infection and 48h after *Aspergillus parasiticus*. The content of carotenoids was determined using high-performance liquid chromatography (HPLC) with an ultraviolet multi-diode detector. Deltametrin application + ECB infection increased content of lutein + zeaxanthin in leaves of hybrid I compared to control (no herbicide application). On the contrary, content of β -carotene decreased after insecticides application, fungal and ECB infection compared to control. In hybrid II the highest content of lutein + zeaxanthin and β -carotene was in control. Also, after deltametrin application + ECB infection content of β -carotene and lutein + zeaxanthin in leaves of hybrid I was higher compare to control + ECB infection. The results indicate that variations in carotenoids content as an antioxidant defense mechanism are caused by abiotic (insecticides) and biotic (fungal and ECB infection) stress.

Keywords: *European corn borer, abiotic and biotic stress, HPLC, Zea mays L.*

MODERN TECHNOLOGY OF GROWING LATERAL WALNUT VARIETIES IN REPUBLIC SERBIA

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Abstract

The progressive growth of walnut production in Serbia has influenced significant innovations in cultivation technology and the introduction of lateral varieties into the culture. Higher planting density, faster yielding, thus faster return of funds favor them in relation to terminal varieties. Intensive plantations are being built in the image of large plantations in California, Italy and Turkey. Planting distance is 6x4m if machine pruning and cultivation form "hedge" or 7x5m if walnut is grown in cultivation forms pyramidal or boiler crown. Leading lateral varieties are Chandler, Peral Lara, Tulare, Fernor as well as pollinators Franquette, Fernet and others. The presence and arrangement of pollinators is a very important segment in the establishment of plantations. From the technological and commercial aspect, the mentioned varieties take precedence for the following reasons: higher oil content in the core, higher yield (ratio of shell and fruit core), easy shell fragility and distinct white core with an average weight of about 14g. The production of lateral varieties of walnuts is disrupted by the appearance of the following harmful agents: *Brenneria rubrifaciens*, *Xanthomonas arboricola* pv. *juglandis* (bacteria), *Gnomonia leptostyla* (fungi), *Zeuzera pyrina* - leopard moth, *Rhagoletis complete* - walnut fly, *Cydia pomonella* - apple weevil (harmful insects). Field work has shown that adult leopard moth appears quite early, at the end of May, and that the larvae on young seedlings in the first and second year do great damage. Stable yield and high quality fruit is possible with adequate protection (6-8 treatments), regular irrigation and fertilization.

Key words: walnut, lateral varieties, harmful agents, cultivation technology.

INVESTIGATION OF Si-LIGNIN INTERACTION BY FLUORESCENCE TECHNIQUES AND ATOMIC FORCE MICROSCOPY- POSSIBLE APPLICATION IN AGRICULTURE

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Abstract

Silica is beneficial element for plants. Many studies of silica show the useful effects that Si can provide on plant-environment relationships in a wide variety of crops, as increase in growth and yield and improvement of resistance to metal toxicity, salt stress, drought resistance etc. The occurrence of Si within a plant is a result of its uptake in the form of soluble $\text{Si}(\text{OH})_4$ or $\text{Si}(\text{OH})_3\text{O}$ ion from the soil, and its polymerization at a final location. Si is mostly accumulated in the cell walls (CWs), thus providing strengthening of CWs, increasing mechanical strength, and alleviating effects of various biotic and abiotic types of stress. Lignin, as one of the main components of the plant CW, is a natural phenolic polymer with high molecular weight and complex structure. Accumulation of silica in plants is directly connected with chemistry and structure of lignin. Silicon affects the composition of CWs by its binding to the phenolic and carbohydrate CW components in polymerization reactions by altering linkages of non-cellulosic polymers and lignin. We studied, in an *in vitro* system, the interaction of SiO_2 with the peroxidase catalyzed polymerization of a lignin monomer into the lignin model compound (DHP). Fluorescence microscopy and spectroscopy combined with AFM technique showed that Si was bound to the final polymer, and the structure of the Si-DHP differed from pure DHP. We show that Si significantly influence on lignin structure. The results contribute to understanding of Si binding to lignin in cell walls, which may have impact on possible Si applications in agriculture.

Keywords: *Silica, lignin, cell wall, fluorescence, AFM.*

DETERMINATION OF COUMAPHOS RESIDUES IN HONEY AFTER VARROA TREATMENT USING FLUORESCENCE SPECTROSCOPY

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Abstract

Varroa infestation is considered a major threat to honeybees due to its strong impact on the colony, attacking larval cells, increasing bee mortality, and serving as a vector of pathogens. Coumaphos is an organophosphate-based acaricide insecticide which is frequently used to control Varroa (*Varroa destructor*) mites in the honey bee (*Apis mellifera*) colonies. The accumulation of these lipophilic contaminants in honey and beeswax may affect honey bee health, mainly honey bee larvae which are the most sensitive, and negatively affect queen quality. In this study, we analyzed honey samples from hives of honey bees that were treated with Coumaphos, as well as the samples of pure Coumafos. The front-face fluorescence measurements of analyzed honey samples were recorded using an F13-221 P spectrofluorimeter, with a 450 W Xenon lamp. Obtained results showed an emission peak with maximum around 400 nm, after excitation at 340 nm. It could be related to the presence of Coumaphos in honey samples, which showed the characteristic position of emission maximum at the same wavelength. These results showed that fluorescence spectroscopy may be useful as a fast and sensitive method, for the efficient and specific determination of toxic substances such as Coumaphos residues in honey. Due to the proven toxic effects on honey bees, as well as on humans, monitoring hazardous contaminants in honey is of crucial importance in the field of food and agriculture.

Keywords: *Coumaphos, honey bee, honey, fluorescence spectroscopy.*

RESVERATROL IN GRAPES - BENEFITS AND POTENTIAL USE

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Abstract

Resveratrol (3,4',5-trihydroxystilbene) is one of the most important polyphenol compounds present in the human diet. From the aspect of agricultural production, resveratrol is also an important component. Grapevine plants produce it as a secondary metabolite that is synthesized to the greatest extent in stressful conditions. These conditions include abiotic and biotic factors such as a lack or excess of water, the content of micro and macro elements in the soil, agrotechnical measures, infections caused by phytopathogenic microorganisms, the presence of chemical stressors such as heavy metals, intensive application of plant protection products (PPP), uncontrolled application of synthetic fertilizers, etc. The most important stressor is infections caused by phytopathogenic organisms, especially the fungus *Botrytis cinerea*, whose presence is a trigger for the synthesis of resveratrol. With the intensive resveratrol production, plants activate the induced defense system, which inhibits the growth and further progression of pathogens. Often, the concentrations of synthesized resveratrol in infected plants are not sufficient to completely suppress pathogens, but they certainly slow down and keep infections at a low level, to provide additional time for us to use adequate protection measures. In addition to the plants that produce it, its application is also possible in the form of a water solution of pure resveratrol that can be applied during the storage of agricultural products to preserve their freshness as long as possible and to reduce the use of PPP in storages. In this paper, an overview of the last references was given to gain an overall picture of how important resveratrol is and how much potential it has from the aspect of human health and plant protection.

Keywords: *resveratrol, phenols, grapevine, Botrytis cinerea Pers.*

EXTRACTION METHODS OF RESVERATROL FROM GRAPES

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Abstract

Resveratrol became recognizable among scientists after the determination of its multitude of benefits for both human health and the plants that synthesize it. From a medical point of view, it is important in the prevention and treatment of many diseases, and from an agricultural point of view, it is part of the defense mechanism of plants, which synthesize it in significant quantities in stressful conditions. To date, many studies have been conducted to examine this compound and all its advantages and disadvantages. To explore new possibilities of exploiting the benefits of resveratrol, it is necessary first to isolate it from the plants that contain it. One of the major sources of resveratrol is the grapevine, which contains most of it in its fruits. Its isolation can be done by many different extraction methods. Extraction represents one of the first and most important steps towards a further analysis of resveratrol. The extraction efficiency depends on many factors and is determined by chromatographic analysis. The aim is to isolate as much resveratrol as possible so that further research can be carried out. This paper provides an overview of the most commonly applied methods, their advantages, and disadvantages, as well as a comparison of some of the conventional and non-conventional methods.

Keywords: *resveratrol, extraction, grapes.*

IN VITRO ANTAGONISTIC ACTIVITY OF TRICHODERMA SPP. TO FUSARIUM OXYSPORUM AND FUSARIUM GRAMINEARUM

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Abstract

One of the major problems in agriculture are *Fusarium* species which cause fusariosis in wheat, corn, tomato, melon, watermelon, onion, peas, and beans. Also, *Fusarium* can synthesize thermostable mycotoxins which can lead to certain diseases if they were found in food. Currently, chemical fungicides are mostly used to prevent the occurrence of fusariosis disease, but the resistance of pathogens to such treatment is being more and more widespread. Soil microorganisms help in plant defense and growth. The rhizosphere fungi have an important role in the mutual exchange of nutrients with plants and they can establish specific interactions with plants. Such rhizosphere fungi are known as plant growth-promoting (PGP). These PGP fungi affect the better plant growth through the synthesis of certain phytohormones but they also have the function as biocontrol agents. They can inhibit the growth of phytopathogens through direct mechanisms of antibiosis, mycoparasitism, and competition. The goal of this research was an investigation of the antagonistic effect of *Trichoderma harzianum* TR1 and *Trichoderma citrinoviride* 1V on *Fusarium oxysporum* and *Fusarium graminearum*. The antagonistic effect was examined through two tests: Dual culture test (DUAL test) and the effect of volatile organic compounds (VOCs) of *Trichoderma* strains on the growth of *Fusarium* strains. Also, the cell-wall degrading enzymatic activity of *T. citrinoviride* and *T. harzianum* was examined. The results showed that antagonistic activity of *Trichoderma* strains varies from moderate to high. Mycelial growth inhibition by *T. citrinoviride* was 44% for *F. graminearum* and 67% for *F. oxysporum*. *T. harzianum* inhibited *F. graminearum* growth for 59% and *F. oxysporum* for 66%. Based on the results, it was concluded that *T.harzianum* and *T.citrinoviride* can be considered biocontrol agents for *F. oxysporum* and *F. graminearum*.

Keywords: *Fusarium oxysporum*, *Fusarium graminearum*, *Trichoderma harzianum*, *Trichoderma citrinoviride*, VOCs, biocontrol agent.

ANTIFUNGAL ACTIVITY OF PLANT ESSENTIAL OILS TO THE FUSARIUM VERTICILLIOIDES ORIGINATED FROM GARLIC

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Abstract

Garlic (*Allium sativum* L.) is the second most cultivated *Allium* species worldwide. Many viral, fungal and bacterial diseases attack garlic plants and can be a limiting factor to garlic production. Fungal diseases control is mainly conducted by fungicides, which have detrimental impact on the environment. In this work, we explore the possibility of utilizing essential oils (EOs) as antifungal agents against a fungal isolate originated from symptomatic garlic cloves from Kraljevci locality, Srem District, Serbia, morphologically and molecularly identified as *Fusarium verticillioides*. EOs used in this study originated from several medicinal plants: Turkish pickling herb (*Echinophora tenuifolia*), oregano (*Origanum vulgare*), basil (*Ocimum basilicum*) and myrtle (*Myrtus communis*). Minimum inhibitory concentrations (MIC) were determined by microdilution method in 96 well microtiter plates. Microtiter plates were incubated for five days at 28°C. The experiment was repeated four times with trifloxystrobin as a positive control. The lowest concentrations without visible growth were defined as the minimal concentrations inhibiting fungal growth. Fungal spores were washed from the surface of potato dextrose agar (PDA) and spore suspension was adjusted to a concentration of approximately 5.0×10^4 in a final volume of 100 µl per well. The values of minimal inhibitory concentration (MIC) were carried out by Duncan's multiple range tests. An analysis of variance was performed on MIC data for four EOs applied on *F. verticillioides*. A significance was evaluated at $p < 0.05$. STATISTICA v.7 (StatSoft, Inc.) was used for statistical analyses. The results of the antimicrobial activity of EOs using microdilution method showed a wide range of antifungal activity against *F. verticillioides*. The basil EO proved to be the most potent one (MIC-0,325±5,10 µg/mL), followed by oregano (MIC-0,775±0,05 µg/mL), myrtle (MIC-5,5±0,05 µg/mL) and Turkish pickling herb (MIC-55±5,10 µg/mL). The data obtained here suggest that the selected EOs can be applied as inhibitors to prevent growth of the phytopathogenic fungus *F. verticillioides*.

Keywords: *Garlic, Essential oil, Antagonistic, Minimum inhibitory concentration*

EFFECTS OF PHYTOPATHOGENS ON THE QUALITY PARAMETERS OF CARROTS SEEDS (*DAUCUS CAROTA* L.) IN A THREE-YEAR PERIOD

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Abstract

Carrot (*Daucus carota* L.) is one of the most important root vegetables in the Apiaceae family grown around the world. Production of carrots in Serbia is generated in Vojvodina with the highest yields 27.4 t/ha, while other regions generate lower yields. Current studies on carrots mainly focus on nutrient content and carotenoid synthesis. Seeds can be infected with phytopathogens, which can contaminate other seeds or spread the infection to other crops. Out of the 16% of annual crop losses due to plant diseases, at least 10% are caused by seed-borne diseases. Changes in the quality of Nantes carrot seeds were monitored for three years (2019-2021). Total germination was highest in the first year with 92% (2019). In 2020, there was a significant decrease in total germination of 8%. Accordingly, germination energy was reduced ($p < 0.05$). A statistically significant difference in total germination was not obtained between 2020 and 2021 ($p > 0.05$). The decrease in total germination from 2019 to 2021 was significant ($p < 0.05$). It has been noticed that the infection of *Alternaria* spp. and *Fusarium* spp. was the lowest in 2019 and increased in 2020 and 2021 (4% and 5%, $p < 0.05$), respectively. The results may indicate an association between the percentage of phytopathogens present and germination. In conclusion, pathogen-free seeds are necessary to create a healthy plant population, better germination and higher yields.

Keywords: *seed, carrot, germination, quality, phytopathogens*

BIOINOCULANTS IN SUSTAINABLE AGRICULTURE – THE INFLUENCE ON MAIZE CHARACTERISTICS AND PHYTOBIOME

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Abstract

Maize (*Zea mays* L.) occupies a significant part of the world cultivated area. Beneficial microorganisms and organic fertilizers are powerful tools for sustainable agricultural management. Applying appropriate formulation either through seed coating or composting material together with seeds during the sowing was aimed to achieve optimal performance on plants and increase the crop yields. Also, a complete analysis of phytobiome including high-throughput amplicon and whole-genome sequencing, and computational biology of the treated and non-treated plants' roots and soil was applied. The statistically significant difference in bacterial communities between phenophases and treatments was much more prevalent in the roots than soil itself. In general, seedling phenophase (II) differed in terms of diversity from bacterial communities of flowering (III) and harvesting phenophases (IV), regardless of treatment, indicating good colonization with the treated substrate for up to one month. In the root samples, the dominance of the genus *Pseudomonas* was evident, in the initial stages (phase II), while this percentage decreased linearly over time. High relative abundance of the genera *Achromobacter*, *Sphingobacterium*, and *Stenotrophomonas* also characterized II phenophase. Contrary, a relative abundance of the genus *Bacillus* was characteristic for III phenophase, and especially twice or three times higher in treatments with phytobiotic or manure compared to the negative control. Furthermore, it was observed that with increasing inoculation of *Bacillus* isolate, the percentage of *Pantoea* genus decreases drastically in coated seeds. In conclusion, a statistically significant increase in maize yield was obtained in the treatment with phytobiotic with an average value of 650 kg/ha compared to the negative control.

Keywords: *Maize, Phytobiotic, Poultry manure, Next Generation Sequencing, Phytobiome.*

MICROBIOLOGICAL QUALITY OF COLD PRESSED PUMPKIN AND WALNUT OILS

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Abstract

The aim of this study was to determine the content of crude oil in seeds and the microbiological quality of cold pressed oils of eight genotypes of pumpkin and walnut from Central and Western Serbia. The oil content in pumpkin seeds of different genotypes ranged from 16.44% to 35.13% per dry matter of whole seed, in the walnut kernel was between 50.17% and 60.41% per weight of the walnut kernel. Genotypes of pumpkin seeds differ significantly in oil content - genotype with the lowest oil content contains only 47% crude oil compared to the genotype with the highest oil content. Among the walnut samples, there is less deviation in the oil content of different genotypes. The number of total bacteria in walnut oil was less than 100 cfu/g. The number of yeasts and mold in walnut oil was very low, even in 3 samples the presence of this microorganisms were not detected, in 4 samples the number was lower than 10 and in the 1 sample the number was between 10 and 100 cfu/g. Two samples of pumpkin oil had a number of bacteria more than 100, but in other samples the number of bacteria less than 100 cfu/g. The number of bacteria, yeasts and molds in the oils of all genotypes was lower than the limit values prescribed in the "Guide to the application of microbiological criteria for food". Sulfite-reducing clostridia were not detected in any oil sample.

Keywords: *crude oil, local genotypes, microbiological quality, pumpkin, walnut.*

STRONTIUM-90 IN MILK AND SOME DAIRY PRODUCTS IN THE REPUBLIC OF SERBIA

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Abstract

Radiostrontium is released to the environment during the testing and use of nuclear weapons mainly in the fifties and sixties of XX century, in addition to nuclear power plant accidents (to some extent in 1986 owing to the Chernobyl accident) and the nuclear fuel reprocessing industry. Strontium is a chemical analogue of calcium (both are earth-alkaline metals) and accordingly when entering a human or animal body, it behaves similar to calcium. A large portion of the strontium will accumulate in bone and teeth and then is included in the metabolism along with Ca, and like calcium, it transfers to milk. Since the strontium uptake by the human body from milk is an important pathway for radiostrontium incorporation, milk and dairy products are good indicators of strontium-90 (Sr-90) content in human diet. Based on the mentioned, the knowledge about Sr-90 content in milk and dairy products is of extreme importance to prevent and control contamination of the food chain. The present study was conducted in order to radiologically control for Sr-90 content in raw milk and some dairy products samples composed of representative locally purchased milk. The analyses are performed using radiochemical analytical oxalate precipitation method, whereby interfering radionuclides are removed by precipitation scavenging. Yttrium-90 (Y-90) is generated from the beta decay of Sr-90. After the ingrowth Y-90 is separated and equilibrium is established, the samples are measured by gas flow proportional counter. The results of investigation showed that Sr-90 activity concentration in many investigated samples was at a lower level than minimum detectable activity (MDA) of the method.

Keywords: *Radiostrontium, radiochemical method, milk and dairy products, Serbia*

COMPARISON OF DIFFERENT EXTRACTION METHODS FOR QUANTIFICATION OF INDIVIDUAL PHENOLIC COMPOUNDS IN WINE BY LIQUID CHROMATOGRAPHY

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Abstract

Two different methods for sample preparation as a preliminary phase for the quantification of individual phenolic compounds were compared with the aim to establish the best conditions for the determination of these compounds in wine samples by ultra-high performance liquid chromatography (UHPLC). Wine of the variety Vozd (newly acquired variety from Faculty of Agriculture in Zemun) was the subject of this study. Grapes were harvested in optimal enological maturity which originated from vineyards belonging to winery "Draskovic" in Vrsac (Serbia). Three different vinification techniques were applied (cold maceration, thermomaceration and carbonic maceration). Cold maceration (C) was conducted at temperature of 4°C (four days) and thermomaceration (T) at temperature of 60°C (heated one hour). For carbonic maceration (CM) it was necessary to use dry ice and that maceration lasted four days. After maceration, pomace was separated and obtained wine samples were bottled and stored until analyses. The analysis of individual phenolic compounds (caffeic acid, *p*- coumaric acid, *p*- hydroxybenzoic acid, rutin and quercetin) in wines was performed by using a coupled with a diode array detector and a triple quadruple mass spectrometer (UHPLC DAD–MS/MS). Quantification of investigated phenolic compounds after solid phase extraction have showed higher concentrations of these compounds in wine, than in samples in analysed without any pretreatment (direct injection).

Keywords: *Phenolic compounds, Wine, Solid phase extraction, Liquid chromatography.*

DRYING KINETICS AND ORGANOLEPTIC QUALITY OF CONVECTIVE DRIED APPLE CHIPS

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Abstract

The aim of this research is to examine the process of drying apple slices by the convective method in order to obtain apple chips with high nutritional value. The growing need for health food products, obtained from processes that do not greatly affect the structure of the original fresh material, has led to a greater interest and demand for fruit and vegetable chips. Compared to the traditional chips, this type of healthy food presumes that the fresh product has undergone minimal thermal treatment, but nonetheless, high quality and microbiological correctness have been achieved during the technological process. Five apple varieties were selected for the experiments: Granny Smith, Gala, Red Prince, Golden Delicious and Breburn. Samples were dried in an experimental dryer at different air velocities (3.5; 4 and 4.5 m/s) and temperatures (60, 65 and 70°C). Prepared apple slices were spread in a single layer on the perforated stainless-steel tray. The samples were removed from dryer for moisture content estimation at an interval of 5 min. In order to improve characteristics of dried product and potentially obtain a new one, some samples were flavored with naturally extracted aromas. This research analyzes drying of several apple varieties with different temperatures and air velocities in order to obtain a high-quality finished product as the final result. Based on the performed experiments, the bases of convective drying mechanisms of apple chips are established.

Key words: *apple, drying, drying kinetics, apple chips*

INVESTIGATING THE FEEDING BEHAVIOR OF THE WHITEFLY *BEMISIA TABACI* ON POINSETTIA (*EUPHORBIA PULCHERRIMA*) USING THE ELECTRICAL PENETRATION GRAPH (EPG) TECHNIQUE

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Abstract

The sweetpotato whitefly, known also as the tobacco whitefly, *Bemisia tabaci* (Hemiptera: Aleyrodidae) is a cosmopolitan insect pest and an important quarantine species in several countries around the world. Both adults and nymphs cause severe damage to many agricultural crops, by direct feeding on plants, excreting honeydew and most importantly by transmitting more than 400 plant viruses. The aim of this research was to monitor and analyze the feeding behavior of *B. tabaci* on treated and untreated plants of poinsettia plants (*Euphorbia pulcherrima*) with 2% solutions of imidacloprid and kaolin clay, using the EPG Giga-8dd (electropenetograph), under laboratory conditions. Whiteflies were attached to the EPG system using silver water-based glue and a gold wire of 12.5 µm thickness. The results showed that both treatments did not significantly affect *B. tabaci*'s feeding behavior, and additional indications showed that the population used in the analysis bears some resistance to imidacloprid.

Keywords: *whitefly, Bemisia tabaci, EPG, feeding behaviour*

CYDALIMA PERSPECTALIS (LEPIDOPTERA, CRAMBIDAE) AS A POTENTIAL THREAT TO CULTIVATED PLANTS IN SERBIA

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Abstract

The box tree moth, *Cydalima perspectalis* Walker, 1859 (Lepidoptera, Crambidae) is native to the temperate and subtropical region of East Asia. It represents economically and ecologically highly significant invasive alien pest in Europe. It was first recorded for Europe in southwest Germany and the Netherlands in 2006, when it was accidentally introduced during international trade of *Buxus* plants. Today it is widespread in Europe. In Serbia, the presence of this pest was confirmed first on box trees (*Buxus* sp.) in the vicinity of Belgrade in 2014. Fast spreading *C. perspectalis* in Europe, high ecological plasticity and multivoltinism indicate high risk of losing box trees from ecosystem - as a consequence of insect monophagy. Additionally, food deficit will cause behavioural changes. The “choice” tests were performed under lab conditions aiming to identify a potential alternative feeding hosts, among 13 selected species of cultivated (legumes, cereals, grapes, walnut, small fruits, stone fruits) and ornamental plants (*Buxus* spp., *Euonymus japonicus*, *Lonicera nitida*). During field inspections, hibernating larvae were collected and released in laboratory experiments. The obtained results imply that pea, cattle pea and beans could be alternative feeding hosts of *C. perspectalis*. Under laboratory conditions, nutrition of *C. perspectalis* was determined on whole pea and cattle pea plants, while damages were recorded only on bean pods. Therefore, visual control on pea and cattle pea fields should become obligatory measure in order to detect early species occurrence and recommend and apply appropriate control of potential outbreak and spreading.

Keywords: *C. perspectalis*, Feeding host, Pea, Cattle pea, Beans.

***PENICILLIUM EXPANSUM* AS A POSTHARVEST PATHOGEN OF TOMATO FRUIT IN SERBIA**

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Abstract

Tomato (*Solanum lycopersicum*, L.) is one of the most widely cultivated crops with high content of vitamins and antioxidant lycopene, which are very important for human health. During the growing season and postharvest storage tomato is susceptible to various diseases caused by pathogenic fungi. In July 2019, tomato (cv. Balkan) with symptoms of blue mold decay were collected from market in Belgrade, Serbia. Macroscopic morphology of three obtained monosporic isolates were observed after growth on Czapek yeast autolysate agar (CYA), creatine sucrose agar (CREA), and malt extract agar (MEA) for seven days at 25°C. Also, selected isolates were incubated at 5, 25, and 37°C for one week on CYA to monitor the effect of different temperature incubation conditions. Colony characteristics and micromorphology of the fungi agreed with the literature descriptions of *Penicillium expansum*. The conidiophores of isolates were hyaline, mainly terverticillate; stipes usually smooth-walled; metulae and phialides cylindrical; conidia ellipsoidal (3-3,86-4 × 3-3,13-4 μm), greenish, smooth-walled. Total DNA was extracted using DNeasy Plant Mini Kit (Qiagen, Hilden, Germany) and partial β-tubulin (*BenA*) sequence was amplified with primers Bt2a/Bt2b. *BenA* sequence of representative isolate ParP/1 was deposited in NCBI GenBank (Accession No. ON186699). Phylogenetic analysis clustered our isolate with other isolates of *P. expansum*. Pathogenicity test was conducted on symptomless, detached tomato fruits. All tested isolates caused typical blue mold symptoms on tomato fruits after seven days of incubation. To our knowledge, this is the first report of *P. expansum* causing postharvest fruit decay on tomato in Serbia.

Keywords: *Tomato, Postharvest decay, Penicillium expansum, Identification*

APPLICATION OF MEDICAL AND SPICE HERBS IN FOOD PRODUCTS IN ORDER TO ACHIEVE GREATER MICROBIOLOGICAL SAFETY AND QUALITY

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Abstract

There is concern around the world about foodborne diseases caused by pathogenic microorganisms. In order to prevent microbiological contamination of food, various methods of preservation are used, with recent efforts focusing on the elimination of synthetic additives and the use of natural antimicrobial agents. Thus, the use of medicinal and spicy herbs has been introduced in order to extend the shelf life and improve the quality of certain food products. Medicinal and spicy plants can be added to food products in their fresh or dried state or in the form of their derivatives such as extracts and essential oils (EO). EO are good sources of bioactive compounds with antioxidant, antibacterial and antifungal activity. Phenolic compounds in essential oils have been identified as the dominant and major antimicrobial compounds. In order to avoid altering the sensory characteristics of food, research is moving in the direction of combining different medicinal and spice herbs with the aim of improving their efficacy, by reducing the effective doses of individual plants. Moreover, research shows that, in addition to the direct use of essential oils in food, there is an increasing discussion about active packaging based on the use of combined materials that can be carriers of essential oils and provide the possibility of their effective release into already packaged food. This paper reviews individual food groups and medicinal and spice plants that have shown to be effective in improving microbiological safety of food products with extended shelf life, without altering the sensory properties in food products.

Key words: *medicinal and spice herbs, microbiological safety, quality, food, active packaging.*

PROGRESS ON THE SELECTION OF A STRAIN OF THE PREDATORY MITE AMBLYSEIUS SWIRSKII ADAPTED TO TOMATO PLANTS

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Abstract

Plant defenses may act against their own interest when they negatively affect the performance of biological control agents (BCAs). Tomato plants are heavily defended with glandular trichomes containing acyl sugars that entrap BCAs to their death, and non-glandular trichomes that hamper BCAs foraging. A potential way to improve BCAs top-down control in highly hostile environments is to exploit the intraspecific genetic variability of populations to create better performing strains. The predatory mite *Amblyseius swirskii* performs well as BCA in many crops, but not on tomato. We investigated what type of tomato trichome is responsible for its low performance via measuring the trait Tolerance to Tomato Trichomes (TTT) on a tomato wild type and three of its mutants expressing different type and abundance of trichomes; we created 20 isofemale lines from a wild population to measure the narrow-sense heritability (h^2) of TTT on each tomato genotype; we designed an experiment combining experimental evolution and artificial selection to create a strain of *A. swirskii* adapted to tomato plants. We found that type VI glandular trichomes were responsible for hampering *A. swirskii* establishment on tomato plants; heritability of TTT was only significant when isofemale lines were exposed to the mutant mostly expressing Type VI glandular trichomes; at initial runs of selection, both the number and the fraction of individuals surviving after being exposed to tomato plants increased slowly, but steadily. Following runs are ongoing to obtain a strain with higher performance.

Keywords: *Experimental evolution, artificial selection, genetic breeding, predatory mites, Amblyseius swirskii.*

OPTIMIZATION OF POSTHARVEST STORAGE CONDITIONS FOR THE RETENTION OF PUNGENCY IN DRIED GINGER AND DEVELOPMENT OF AN IOT-BASED REAL-TIME STORAGE MONITORING SYSTEM

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Abstract

The aromatic rhizome of Ginger (*Zingiber officinale*) is widely used as a spice and flavoring agent. This study investigated the influence of selected postharvest storage conditions on the retention of quality and pungency in dried ginger rhizomes intended for the extraction of ginger oleoresin, to be incorporated in local carbonated soft drinks to emulate the flavor and pungency of natural ginger. Response Surface Methodology (Box Behnken design; n=15) was used to optimize the storage process of dried ginger rhizomes by evaluating the pungency [Total Phenolic Content (TPC) by Folin–Ciocalteu assay] and the de-wetting behavior (by cumulative mass loss/gain), controlling three parameters: temperature (4⁰C to 20⁰C), relative humidity (RH) (40% to 80%), and storage time (20 to 40 days). A compression test was conducted (Brookfield CT3-1500 Texture Analyzer) to analyze the hardness of the dried ginger samples followed by chroma analysis (Konica Minolta CR-400 Chroma Meter). The real-time sensing and control system to monitor the temperature and the RH of the storage chamber was fabricated using the Arduino Mega 2560 Microcontroller board using appropriate sensors and controllers (DHT11, LDR and Relay modules; Arduino IDE 1.8.10). The Internet of Things (IoT) interface was provided using the ESP-8266 NodeMCU module connected with an android system (Blynk IoT platform) via Wireless Fidelity (Wi-Fi). The de-wetting behavior of dried ginger indicated a minimum at 20⁰C and the difference in the TPC of dried ginger (indicator of the ginger pungency) showed the minimum at 4⁰C. The effect of tested storage time and temperatures was significantly different (p<0.05) over the TPC of dried ginger slices. The effect of tested temperatures was significantly different (p<0.05) over the de-wetting behavior while the effect of the interaction between temperature and RH was significantly different (p<0.05) over the hardness of the dried ginger slices. The effect of the tested parameters and their interactions over yellowness index, whiteness index and the total colour change was not significantly different (p>0.05) over the optical properties of the dried ginger slices. The outcome of this study could be used as a viable real-time monitoring approach for the postharvest quality maintenance of ginger.

Keywords: *Dried ginger, Storage, Optimization, Ginger pungency, IoT*

EFFECTS OF GARLIC OIL ON THE FECUNDITY AND HATCHABILITY OF CALLOSOBRUCHUS MACULATUS L. (COLEOPTERA: BRUCHIDAE)

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Abstract

Laboratory experiments were conducted in the Department of Crop Protection, Faculty of Agriculture, University of Khartoum, Shambat, to evaluate the efficacy of the three types of garlic oils; Sudanese (local), Chinese and Egyptian on the eggs of cowpea beetle *Callosobruchus maculatus*. Volatile oils from Sudanese and Chinese garlic were obtained by steam distillation and soxhlet extraction using ethanol correspondingly, whereas Egyptian (ready-made) garlic oil was bought from a perfumery at Omdurman market. The oils were tested at concentrations of 0.01%, 0.1%, 1%, 5% and 10%, at exposure periods ranging from 24 to 72hrs. The respective average number of eggs laid after exposure to the lowest concentration of Sudanese, Chinese and Egyptian oils were; 5.4, 4.0, 4.1 for 24 hrs; 0.7, 0.1, 0.1 for 48 hrs 0.2, 0.5, 0.5 for 72 hrs. Volatile oils from the three garlic cultivars significantly reduced the number of eggs laid and caused complete inhibition. The higher dose (10%) of all garlic oils obviously caused complete inhibition of eggs hatchability compared to the others concentrations. The average number of eggs hatched when exposed to the lowest concentration (0.01%) were; 0.25 for 1st day and 1.00 for 7th days for Sudanese, 0.00 for 1st day and 0.75 for 7th days for Chinese and 0.00 for 1st day and 0.75 for 7th days for Egyptian. There were significant differences between treatments and the control.

Keywords: garlic oil, coleoptera.

EVALUATION OF MICROBIAL BIOSTIMULANTS IN SOILLESS CULTURE OF SESSILE OAK (QUERCUS PETRAEA)

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Abstract

In the context of new regulations enforced in Europe to decrease the use of chemical pesticides, the development of organic production in plant and tree nurseries is considered as a major challenge in horticulture. The renouncement of synthetic inputs and peat-enriched substrates move professionals to review their production model, with the goal that productivity and quality are not diminished, ensuring by that the necessary economic viability of ornamental nurseries. The difficulty is to find effective alternatives to coated mineral fertilisers and peat, which are still widely used. Microbial biostimulants would be an interesting way to facilitate nutrient uptake and limit the effect of stresses more likely to occur in soilless conditions. Several FIBL-approved biostimulants are available, but the lack of feedback on their effectiveness limits their use. In this trial, three commercial biostimulants, MYC800, HÉLÈS and GEFA were evaluated on 40 oak trees, after a single application. Trunk circumference at 1 m height was measured at regular intervals over a period of 23 months from 2019 to 2020. The growth gains observed compared to the control ranged from 11.33% to 34.40% over this 23 months period. Comparisons between the 2019 and 2020 vegetative growth seasons showed that the effects of the microorganisms are enhanced in the second year. The average gains observed in 2020 were very significant for HÉLÈS and GEFA with respectively 58.28% and 59.83% increase in average trunk growth compared to the control. The results of this limited study encourages pursuing testing microbial biostimulants in ornamental nurseries.

Keywords: *Bacillus methylotrophicus*, *biostimulant*, *Glomus intraradices*, *mycorrhize*, *Quercus petraea*.

ISOLATION, IDENTIFICATION AND EVALUATION OF NATIVE ENTOMOPATHOGENIC FUNGI ON *GALLERIA MELLONELLA*

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Abstract

The fall armyworm, *Spodoptera frugiperda* (Lepidoptera: Noctuidae) is a polyphagous pest responsible for enormous damage to maize in Africa, particularly in Ivory Coast. In order to find an alternative to chemical products generally used against this pest, entomopathogenic fungi could be an efficient choice. Using the method of trapping with *Galleria mellonella* as a bait, 86 fungal strains were isolated from soil samples collected in maize fields in three locations. The genetic identification of these fungi revealed seven isolates of *Metarhizium*, three isolates of *Beauveria bassiana* and two isolates of *Trichoderma* sp. The pathogenicity of these fungi was tested on 5th instar larvae of *G. mellonella* at a concentration of 5×10^6 spores/mL. Larval mortality rates were determined seven days after treatment. The median lethal time (LT50) for each isolate was also determined. *Beauveria bassiana* isolate A214b was the most effective with 100% mortality and an LT50 of 2.64 days. The other isolates (A211, A214a) of *B. bassiana* all also caused 100% mortality with respectively LT50 3.44; 4.04 days. As for the *Metarhizium* isolates, the mortality varied from 65.38% to 100%. *Metarhizium* isolate T331 was the most virulent among these with a mortality of 100% and LT50 of 3.08 days. The *Trichoderma* sp. isolates were the least pathogenic, their mortality rates varied from 3.33 % to 16.7 %. Isolates of *Beauveria bassiana* and *Metarhizium* sp. therefore have a potential virulence against *G. mellonella* larvae and should now be tested on *S. frugiperda*, for potential biocontrol of this pest.

Keywords: *Beauveria bassiana*, biological control, Fall armyworm, *Metarhizium anisopliae*, *Spodoptera frugiperda*.

EVALUATION OF BIOSTIMULANTS IN SOILLESS GLASSHOUSE COMMERCIAL TOMATO CULTURES

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Abstract

Biostimulants are now considered as full-fledged agricultural inputs and represent a highly attractive business for phytopharmaceutical companies. Seaweed extracts may compose such biostimulants and are considered for their properties to reduce abiotic stress and increase crop yield. Extracted from several algae species, they contain complex active substances, of which the precise mechanism of action implied in the response is unknown, little described or understood, even if many trials report very positive results. We tested here two commercial products, “Toni Flore” and “Algo + Tonic B”, from the company BIO 3G, containing two seaweed extracts, on a cherry tomato variety DR0607TC in a commercial soilless production. The trials were run for five months in spring 2021 in commercial soilless tomato production in Geneva, under a randomized scheme with three modalities. The recorded parameters were stem growth, yield, average fruit weight, Brix level, acidity, firmness, lycopene concentration and colour. The average yield was significantly higher along the whole time length for the treatment Algo + Tonic B. The plant stem diameter was systematically higher from 12th March for the treatment Algo + Tonic B. A similar effect was observed with Toni Flore, but only from May 28th. The firmness was systematically higher with Algo + Tonic B than in two other modalities. No effect of the biostimulants was observed in lycopene level, acidity or colour. These trials showed that these biostimulants have positive effects on some parameters, with Algo + Tonic B being the most promising biostimulant in tomato soilless culture.

Keywords: *biostimulants, glasshouse, soilless, glasshouse.*

EVALUATION OF ISOLATES FROM THREE ENTOMOPATHOGENIC FUNGAL SPECIES AGAINST *DROSOPHILA SUZUKII*

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Abstract

The fly *Drosophila suzukii* has been causing significant damage, in Europe since 2008, in commercial thin-skinned fruit crops, by laying large eggs numbers during fruit ripening. Integrated pest management is therefore acutely needed against this pest, and should combine complementary prophylactic, physical, and biological control methods. Chemical insecticides interfere with biological control and environmental balance. They also leaves residues on fruits and likely triggers resistance in *D. suzukii*. This study aimed to evaluate the potential of six entomopathogenic fungal strains against this pest in laboratory conditions. They belong to the species *Paecilomyces fumosoroseus*, *Beauveria bassiana* and *Metarhizium anisopliae* and were selected because of their effectiveness against *D. suzukii* by direct spraying. Two innovative application techniques were tested. A first trial evaluated the endophytic potential by inoculation of strawberry plants with these six fungal strains through their effect against *D. suzukii*, as well as on fruit yield and plant growth. After 20 days, no significant effect was observed on fruit protection, but a slightly positive effect was observed on fruit yield with two of the six strains. Concerning plant growth, a significant positive effect was observed on the average root dry weight of plants with three fungal strains. A second trial evaluated the mortality caused by the ingestion of a liquid diet supplemented with conidia of entomopathogenic fungi and provided by a micro-watering trough. Two strains showed good lethal potential, the best strain causing an average mortality of 82% after 18 days of diet. These preliminary studies should therefore be continued.

Keywords: *entomopathogenic fungi*, *Beauveria bassiana*, *Metarhizium anisopliae*, *Paecilomyces fumosoroseus*, *strawberry*.

ASSAYS OF MICROBIOLOGICAL CONTROL AGAINST PSEUDOMONAS SYRINGAE PATHOVARS CAUSING THE BACTERIAL CANCKER OF KIWI

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Abstract

The bacterial cancker, caused by *Pseudomonas syringae* pv. *actinidiae* (Psa), is the most severe disease of cultivated *Actinidia* species. However, *Actinidia arguta*, commonly known as kiwifruit, seems to express some tolerance. The pathogen is systemic and therefore not easily controllable by agrochemical products. We here attempted to search, select and identify bacterial potential biostimulant bacteria from the endophytic microbiota of the fruit *Actinidia arguta*. The expectation was to find possible antagonists able to control *Pseudomonas syringae* pv. *actinidiae* or other *Pseudomonas syringae* isolates pathogens of kiwi. Two kiwifruit production orchards (Vaud, Switzerland) with a recent history of kiwi bacterial cancker on *Actinidia chinensis* were sampled to detect and isolate the bacterium Psa. Though Psa has not been isolated from symptomatic kiwi trees, with characteristic bacterial canckers, another unknown pathovar was isolated and genetically identified as *Pseudomonas syringae* pv. *syringae*. Bacterial endophytes isolated from plants of the species *Actinidia arguta* cv *Ambrosia amuna* as well as biostimulant and antagonistic bacterial strains from our laboratory collection were tested for their ability to inhibit the growth of the *Pseudomonas syringae* isolates. Totally 26 different bacterial endophytes or biostimulant and antagonistic bacteria were tested. Two of them, belonging to the genus *Bacillus*, were able to inhibit in vitro the growth of the *Pseudomonas syringae* pv. *syringae* strain isolated from kiwi orchards. If some complementary experiments have to be carried out for evaluating the safety of these bacteria in kiwi, these results are promising and the evaluation of these strains against Psa and other *Pseudomonas syringae* pathovars should be pursued.

Keywords: *Actinidia* spp., bacterial cancker, microbiological control, *Pseudomonas syringae* pv. *actinidiae*, *Pseudomonas syringae* pv. *syringae*.

THE SPECIES DIVERSITY OF THE INSECT NATURAL ENEMIES FOR BIOLOGICAL PEST CONTROL OF SOLANACEOUS CROPS

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Abstract

This study was initiated in 2020. The objectives are survey identification and analysis of digital data set of species and geographic distribution of insect pests of solanaceous crops in Chiang Rai, Chiang Mai, and Payao provinces, Thailand. The study area is latitude 17-19 °N to longitude 98-100 °E. The solanaceous crops included chili, tomato, eggplant, and potato grown in the agricultural system to investigate insect pests and insects' natural enemies. Fifteen species are grouped as leaf sucking insects and lepidopterous larvae. Associated natural enemies detailed for further Geographic Information System (GIS) model in order to Biological Pest Control were 21 species, consisting of predatory insects and parasitoid at 18 and 3 species, respectively.

Keywords: *Insect pest, parasitoid, predatory insects, solanaceae*

SOME NOTES ON SCALE INSECTS, DAMAGING ORNAMENTAL PLANT AND NEW RECORDS IN TUNISIA

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Abstract

A survey was conducted during 2008-2022 period to identify the scales insect species in eight Tunisian coastal governorates on ornamental plant, their host plant and document their geographic distribution. Eighteen species belonging to four family were identified: Diaspididae (*Aonidia lauri* Bouché, *Aonidiella aurantii* Maskell, *Aulacaspis rosae* Bouché, *Chrysomphalus aonidum* L., *Leucaspis pusilla* Löw, *Parlatoria ziziphii* Lucas), Coccidae (*Ceroplastes floridensis* Comstock, *Ceroplastes rusci* L., *Saissetia olea* Olivier, *Coccus hesperidum* L.), Pseudococcidae (*Maconellicoccus hirsutus* Green, *Phenacoccus peruvianus* Granara de Willink, *Phenacoccus madeirensis* Green, *Planococcus vovae* Nasonov, *Planococcus citri* Risso, *Ferrisia virgata* Cockerell and *Pseudococcus longispinus* Targioni-Tozzetti) and Margarodidae (*Icerya purchasi* Maskell). In this study, we reported the *L. pusilla* on *Pinus halepensis* (Pinaceae), *Coccus hesperidum* on *Musca* sp. and the secondary host *Dracenea marginata* (Agavaceae) of *C. aonidum* for the first time in Tunisia. Faunistic studies are important for documenting new distributional data and notifying researchers to potential exotic pests and invasive species.

Key words: *Scale insects, ornamental plant, invasive species, geographical distribution, Tunisia.*

EFFECT OF ROSEHIP SEED POWDER ON THE QUALITY OF MUFFIN CAKE

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Abstract

The evolution of living conditions and consumer demand for healthier and more functional products are giving a new direction to the food sector. Moreover, zero-waste projects and waste management are gaining importance day by day to solve the food supply problems caused by the growing population and seasonal influences. In this study, an attempt was made to use the rosehip seed powder obtained from the production of rosehip seed oil, which is used in the cosmetic industry, to make muffin cakes. In this context, rosehip seed powder was added to wheat flour in 5 different ratios (5, 7.5, 10, 15, and 20%) and muffin cakes were prepared. The structural properties (volume index, symmetry index, uniformity index, upper shrinkage value, lower shrinkage value and total volume index), chemical properties and color values of the muffins were determined. The results show that the addition of rosehip seed powder increases the protein content, total phenolic content, and total antioxidant capacity of the muffins. While the addition of rosehip seed powder at 5% improved the structural properties of the muffins, negative effects occurred at higher addition levels. As a result, it was found that the rosehip seed powder can be used in cake making and increases the functionality of the products to which it is added.

Keywords: *Functional Foods, Muffin, Rosehip*

SIGNIFICANCE OF GOAT MILK IN NUTRITION

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Abstract

Recently, research suggests that goat milk can be used as biofunctional food owing to its superior features and bioactive compounds it contains. Goat milk (25-30 mg/100 ml) has the closest composition to human milk as it contains more oligosaccharides than cow's milk (2-3 mg/100 ml). Studies have reported that the oligosaccharides in goat milk regress enteritis, contribute to the restoration of the gastrointestinal tract flora and are used in the treatment of ulcers. After human milk, goat milk contains the highest amount of sialic acid which figures in protection of the intestinal mucosal cells against pathogens and the development of the brain in newborn infants. Goat milk is more advantageous in terms of digestibility than cow's milk due to smaller oil globules. It has lower cholesterol in comparison to other species of milk. Goat milk contains quite a lot of bioactive proteins. It has a higher nucleotide number than cow's milk which help augment immune reponse. Goat milk is an excellent source of antioxidant and has tumor suppression properties with its high content of vitamin A and niacin. It is distinguished from milk of other species with its high Cl and P content. The market of goat milk and its product can be invigorated by informing people about the functional characteristics of goat milk. Goat milk production and consumption can be increased in countries where cow's milk is not available. Since it is a special nutrient in terms of its bioactive content, researches on these special contents should grow. It must be added to the diets of babies and people who live with chronic diseases.

Keywords: *Goat milk, Nutrition, Healt*

INVESTIGATION ON THE BIOLOGICAL ACTIVITIES OF *SCOLYMUS HISPANICUS* L.

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Abstract

Scolymus hispanicus L. belongs to the Asteraceae family. It is known as Akça kızı, Çetmi diken, Kızılgöz diken, Sarı diken, altın diken in Turkish. The aim of this study is to analyze the biological (antioxidant, anticholinesterase and antimicrobial) activities of *Scolymus hispanicus* L. petroleum ether, chloroform and methanol extracts obtained by using maceration method. DPPH, CUPRAC, and FRAP techniques were used to examine the antioxidant properties of plant' extracts. The extracts' anticholinesterase and antimicrobial activities were determined using the Ellman and Agar well diffusion techniques, respectively. It was determined that the methanol extract obtained from the plant showed the strongest antioxidant activity when compared to the other extracts. Also among the three extracts it was assessed that the chloroform extract had the highest anticholinesterase potential activity. Additionally, it was found that the petroleum ether extract of *Scolymus hispanicus* L. was effective against *Acinetobacter baumannii*, *Candida tropicalis* and both *Staphylococcus aureus* strains and its chloroform extract was effective against both *Staphylococcus aureus* strains.

Keywords: *Scolymus hispanicus* L., Antioxidant activity, Anticholinesterase activity, Antimicrobial activity

**PROBIOTICS EFFECTS ON SOME BIOLOGICAL PROPERTIES OF
TRICHOGRAMMA EVANESCENS (HYMENOPTERA: TRICHOGRAMMATIDAE)**

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Abstract

Trichogramma spp. have been used to control lepidopteran pests for many years. They have been termed the *Drosophila* of the parasitoid world since they have been used for inundative releases and studies with them have given a lot of information. It is a tiny, low-maintenance fly that's emerged as the best insect model for studying developmental biology and genetic functional analyses. Probiotic bacteria have grown in popularity over the last two decades as a result of the growing body of scientific evidence demonstrating their positive impacts on human health. Microorganisms, particularly bacteria, influence insect vital activity in either a positive or negative way. *T. evanescens* was reared in the laboratory for numerous generations on *Ephesia kuehniella* eggs at 27±°C, 70± 5% relative humidity, and a photoperiod of 14:10 (L:D). Adults were given one of four treatments: control, honey + 0.005 g probiotics, honey + 0.010 g probiotics, and honey + 0.015 g probiotics. *Lactobacillus acidophilus*, *Lactobacillus rhamnosus*, *Lactobacillus reuteri*, *Bifidobacterium bifidum*, *Bifidobacterium longum*, *Bifidobacterium breve*, and *Streptococcus thermophiles* were all commercially available probiotics employed in the study. The goal of this study was to see how probiotics affected various biological properties of *T. evanescens*. Adult *T. evanescens* were given varied dosages of probiotics, and the study's findings included developmental time, parasitization, and sex ratio.

Keywords: *Trichogramma evanescens*, probiotic, model organism, developmental biology.

16S rRNA VS BIOCHEMICAL TESTS: CHALLENGE TO IDENTIFY PINK PIGMENTED *ERWINIA* SPECIES

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Abstract

Genus *Erwinia* has many important and destructive plant pathogenic species in wide host range. The species within the Genus show different morphologic structures in different culture media. Some of the species characterized typical pigmentation on different solid media such as Nutrient Agar and Yeast Extract CaCO₃ Agar. Phytopathogenic pink pigmented species of the Genus are known as *Erwinia persicina* and *Erwinia rhapondici*. Besides colony morphology, biochemical tests are still a unique and indispensable part of bacterial taxonomy. Today, molecular methods are applied as an integral part of the definitive characterization of an organism together with morphological and biochemical characteristics. The sequence of 16S rRNA gene region is the most widely used molecular technique for the identification of prokaryotes. In this study five pathogenic, pink pigment producer lettuce strains showing 16S rRNA gene sequence similarity were clarified by using some discriminative biochemical tests. Methyl red and Voges-Proskauer tests and dulcitol, glycerol, meleziotoze, and D-xylitol usage of the strains were assessed as discriminative biochemical tests. The strains were recorded as negative on methyl red test, positive on Voges-Proskauer, negative for the usage of dulcitol, glycerol, meleziotoze and D-xylitol. The results revealed that, although the sequence of 16S rRNA sequence results provides very high accuracy, a combination of discriminative biochemical tests beside 16S rRNA gene sequence provides a confident identification of the pink pigmented *Erwinia* species.

Keywords: *Erwinia*, pink pigmentation, 16S rRNA, methyl red, Voges Proskauer

THE TOMATO LEAFMINER, TUTA ABSOLUTA MEYRICK (LEPIDOPTERA: GELECHIIDAE) IN TURKEY: CURRENT STATUS

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Abstract

Tomato (*Solanum lycopersicon* L.) is a major open-field and greenhouse vegetable crop grown throughout the world. Turkey is in the third rank among the top three tomato-growing countries in the world, after China and India with a production amount of 13 million tons. The tomato leafminer, *Tuta absoluta* Meyrick (Lepidoptera: Gelechiidae) is one of the most devastating pests of tomatoes in Turkey since it was first recorded in 2009. In the last 13 years, the pest has continued its spread and invaded all of the main tomato-growing provinces in Turkey. *Tuta absoluta* has led to severe damage to tomato production both in open-fields and greenhouses. Chemical control has still the most preferred control method by the farmers in Turkey in order to prevent crop loss derived from *T. absoluta*. However, due to resistance development, failure in chemical control has often been reported. Other control methods such as mating disruption and mass trapping have also been implemented in the control of the pest and the results showed that they were promising alternatives to chemical control. This paper presents the biology of the tomato leafminer according to the regions, damage and economic importance, control methods, updated distribution map, new host plants, and the current status of *T. absoluta* in Turkey. The available literature was briefly reviewed in order to provide an overview of the current knowledge on this pest.

Keywords: *Tomato, Tomato leafminer, Tuta absoluta, Turkey.*

UTILIZATION OF EDIBLE NANOEMULSION COATINGS IN MEAT AND MEAT PRODUCTS

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Abstract

Due to the increasing consumer demands for minimally processed food, the meat industry has tended to replace traditional techniques (heat treatment, salting, curing, etc.) with non-thermal processes to preserve meat quality. Among active packaging technologies, the use of edible coatings in the meat industry has important advantages such as being environmentally friendly, economical, long shelf life, good barrier properties, and carriers for bioactive compounds. The addition of functional agents has demonstrated its effectiveness in extending the shelf life of fresh and processed meat products. However, despite this effectiveness, there are few edible active coatings available in the market. This deficiency is mainly due to the low stability of the active ingredients during production processes and storage. Emulsion technology is a simple, economical, and effective method of keeping the hydrophilic phase and lipid in a stable system. The addition of lipophilic components can be enhanced coating stability by preparing the coating solution in emulsion form. Reducing the droplet size of emulsion to nano size is increase the functionality of edible coating. Droplet size and distribution of nanoemulsions have a significant impact on functionality, stability of the emulsion as a carrier, and more homogeneous distribution of the lipophilic material. Nanoemulsions have been widely used in the food industry in recent years as an innovative approach to transporting functional agents such as fatty acids, polyphenols, antioxidants, antimicrobials, etc. This paper will provide a review of development techniques of edible nanoemulsion coatings and use as a substitute for synthetic polymers and their applications in the meat industry.

Keywords: *Meat products, Active packaging, Edible coating, Edible nanoemulsion coating*

DETERMINATION OF THE RACES OF *FULVIA FULVA* AND MUTATIONS IN AVR GENES IN TURKEY

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Abstract

Tomato leaf mold caused by *Fulvia fulva* is an important disease of tomatoes. In this study, a total of 205 *Fulvia fulva* isolates were obtained from Antalya, Muğla, Mersin, Burdur, Bartın, and Zonguldak provinces of Turkey. The differential set used in the identification of the races of the pathogen was obtained from the Czech Republic Gene Bank. Pathogenicity tests were carried out with 60 single spore isolates from different provinces using genotypes containing Cf-0, Cf-2, Cf-4, Cf-5, Cf-6, Cf-9, and Cf-4/11 resistance genes. Two-week-old fungal cultures were used and the spore suspensions adjusted to 10⁵ conidia/ml with a hemocytometer were sprayed to the tomato seedlings at the 4-5 leaf stages. Plants inoculated in three replications were placed in 30 l plastic boxes and moistened at regular intervals and they were incubated for 20 days at a temperature ranging 25-28°C under greenhouse conditions. Genotypes with yellowing and dense fungal cover under the leaves were evaluated as positive. *Fulvia fulva*, races 2, 2.4, 2.5, 2.9, 2.11, 2.4.5, 2.5.9, 2.4.11, 2.5.11, 2.9.11, and 2.4.5.9.11 were identified. The most common races were 2 and 2.5. The races of a total of 60 isolates were determined. In addition, mutations in the Avr2, Avr4, Avr4e, Avr5, and Avr9 genes were examined. No mutation was detected in the Avr4 gene and it was identified as wild-type. Mutations, c.29T>C, c.429-430AG>GA, c.431insA in the Avr2 gene; c.577-578insG, c.577-578insGG in the Avr4e gene; c.1104G>A in the avr5 gene, c.567A>G, c.582-583insG in the Avr9 gene have been identified. There were also isolates which Avr4e and Avr5 genes were identified as wild-type.

Keywords: *Tomato, leaf mold, Fulvia fulva, races, Turkey*

Acknowledgements: This study constitutes a part of the first author's Ph.D. thesis, and it is supported by the Ankara University Scientific Research Projects Coordinatorship (BAP) Project number: 19L0447003.

EFFECTS OF ANTI-BROWNING SUBSTANCES WITH HONEY ON QUALITY OF APPLE SLICES DURING STORAGE

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Abstract

Fresh-cut or minimally processed fruits have gained particular attention recently and their consumption has been increasing. However, physiological disorders such as browning on the cut surface along with losses in water and texture quality in these products proceed more rapidly compared to intact products and thus their shelf life is shorter. In the current study, effects of anti-browning substances such as citric acid and ascorbic acid employed with honey on slice quality and browning of apples *cv.* Granny Smith were investigated during cold storage. Apple fruits harvested at commercial maturity were divided into lots and the sliced commodity were immersed into pure water (control) or solutions of 2% ascorbic acid, 1% citric acid, 10% honey, 2% ascorbic acid plus 10% honey or 1% citric acid plus 10% honey. Treated slices were packed and stored at 4°C for 15 d. Honey combined with ascorbic acid treatment after slicing were effective on decreasing the weight loss, maintaining the firmness, titratable acid and visual quality and delaying the browning incidence of slices. Considering the overall investigations, treatments of ascorbic acid combined with honey after slicing were effective on protecting the postharvest quality of apples *cv.* Granny Smith during 15 days storage.

Keywords: *Fresh cut, Granny Smith, browning, honey.*

DRY STRAWBERRY SNACK

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Abstract

It is important for today's consumers to consume high nutritional value, low calorie, and healthy food. For these reasons, the consumer tends toward the most natural and the healthiest. Fruits have a great place in the human diet. Strawberry is one of the most popular fruits preferred by consumers. It is known for its high nutritional value and organoleptic properties. Strawberry has high levels of bioactive compounds, which has a very short shelf life due to the softening of the texture which makes it more difficult to be consumed as fresh fruit. For these reasons, different applications have been developed to process fresh fruit and extend its shelf life. One of these applications is the osmotic dehydration process. Osmotic dehydration is the process of removing water from the food that involves heating food in a hypertonic solution. By osmotic dehydration, the water activity of the food decreases. The removal of water from the food is important to protect it from spoilage. The osmotic dehydration process can be done with concentrated sugar as well as a natural sweetener such as stevia. The purpose of using stevia in osmotic dehydration is to minimize the energy coming from sugar and to obtain a natural energy source. The result is to produce low-calorie snacks. The aim of this study is to evaluate the effect of stevia used in combination with sucrose on some quality parameters of dried strawberries.

Keywords: *Strawberry, Osmotic dehydration, Stevia, Quality Parameters*

FORMS OF VEGETABLE ADDITIVES AND COOKING TIME EFFECTS ON SOME CHARACTERISTICS OF CHICKEN TANTUNI, A TRADITIONAL TURKISH FOOD

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Abstract

Tantuni is a type of Turkish traditional meat product produced by adding tomatoes, onions, peppers and spices to strips of chicken or beef. It is cooked in a special tantuni pot by adding water. In this study, it was aimed to investigate the effects of different forms of additives and cooking times on some quality characteristics of chicken tantuni for the first stage of developing packaged tantuni exposed for sale in markets. For this purpose the dried particulates or powdered forms of tomato, green pepper, onion and parsley were used in the formulations and the production was carried out in accordance with traditional chicken tantuni by applying different cooking parameters (35 and 45 minutes) in pot. Then the samples were modified, atmosphere packaged and stored at 4°C during 28 days. Proximate composition (moisture, ash, fat and protein), color measurement, TBARS and sensory evaluation analyzes were performed in the samples. The L^* values of the samples with the powder additives were found to be significantly lower than the L^* values of the samples with dried particle additives ($P<0.05$). Powder form of additives caused a darker color in samples according to the particulates form. A significant increase was detected in the lipid oxidation rates of all sample groups at the end of the storage (28th day) compared to the first day ($P<0.05$). It was determined that the sample groups prepared with dried particle additives had the highest sensory evaluation scores in terms of flavor and overall acceptability ($P<0.05$).

Keywords: *Tantuni, Traditional Turkish Food, Vegetable Additives, Cooking Parameter.*

Acknowledgments: This study is supported by Ege University Scientific Research Projects Coordination Unit. and Keskinoglu Poultry and Breeding Plant within the scope of University-Industry Participating Project FKP-2020-21593.

POLYCYCLIC AROMATIC HYDROCARBONS (PAH) IN BEEF DONER KEBABS COOKED IN DIFFERENT COOKING PARAMETERS IN AN ELECTRIC DONER MACHINE

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Abstract

Doner is one of the traditional meat products of Turkey and is also known almost all over the world. The current doner machines used for cooking doner operate electrically, with gas or wood fire. Doner block rotates against the heat source vertically and cooks with different cooking parameters. Depending on the cooking parameters, carcinogenic compounds such as PAH may occur in foods. In this study PAH contents of doner cooked using different distances to heat source (10 or 15 cm), machine resistants (2 or 3 parts), and cooking time (3 or 4 minutes) were determined. B(a)a and Chr compounds were detected by fluorescence detector at a wavelength of 254 nm/390 nm, while 260 nm/420 nm for B(b)f and B(a)p. B(a)p content of doner samples was determined in the range of 0.36-0.63 µg/kg. The lowest B(a)p content was in the sample that was cooked at 10 cm distance, 2 resistants, and 3 min. It is observed that the PAH content of the doner cooked in the electric doner machine does not exceed the limit values of 2.0 µg/kg determined by the European Union Legislation (EC No: 1881/2006). It was determined that the total PAH content varied in the range of 3.20-7.27 µg/kg. The highest total PAH content was in the sample that was cooked at 10 cm distance, 3 resistants, and 4 min. It has been determined that the PAH content of the doner cooked in the electric machine is below the limit values of 12.0 µg/kg determined by the European Union Legislation (EC No:1881/2006).

Keywords: *Polycyclic aromatic hydrocarbon, benzo[a]pyrene, doner kebab, electric doner machine.*

Acknowledgments: The authors are grateful for financial support provided for the project no:1200478 by The Scientific and Technological Research Council of Turkey (TUBITAK).

THE EFFECT OF PEELING, FILLING MEDIUM AND STORAGE ON THE PHYSICO-CHEMICAL QUALITY OF CANNED FIGS

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Abstract

Fig fruit (*Ficus carica* L.) is one of the most important agricultural products of Middle East and Mediterranean region. Fig as one of the major export products of Türkiye but it deteriorates very quickly due to its perishable nature. Thus, to provide their storage stability, canning process were carried out on Sarılop and Bursa Siyahı fig varieties. The objective of this study was to evaluate changes in physico-chemical properties of canned figs such as pH, total soluble solids, titratable acidity, clarity index color and hardness. For this purpose, peeled and unpeeled Sarılop and Bursa Siyahı fig varieties were preserved in different filling mediums such as water, syrup and fig juice and stored at room temperature for 12 months. Firstly, canned figs in each were separated for sterility tests after canning process. Moreover, fruit weight, drained weight ratio, pH and Brix values of fig and filling medium were determined and it was observed that the canned figs became stable at the end of the 16th day. The stored samples were analyzed at three-month intervals. The physicochemical properties of canned fruits vary depending on the fig varieties. Fruit size and weights of Sarılop figs were different from Bursa Siyahı figs. In terms of fruit hardness, the canned unpeeled figs of Bursa Siyahı variety had higher values. According to color analysis, peeled fig samples showed higher L values. Results showed that canning process did not effect the natural structure of figs, and it was determined that the physicochemical analyzes did not change significantly during storage.

Key words: *ficus carica, canned fig, fig juice, Sarılop, Bursa Siyahı,*

**EFFECT OF SOME TRAP COMBINATIONS ON AGONOSCENA PISTACIAE
BURCKHARDT & LAUTERER, CACOPSYLLA PYRII L, LEAF PSYLLIDS,
(HEMIPTERA: PSYLLIDAE)**

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Abstract

This study was carried out to understand the effects of a some trap combinations against to *Cacopsylla pyrii* L. and *Agonoscena pistaciae* Burckhardt & Lauterer (Hemiptera: Psyllidae) which are the important pests on pear and pistachio. With this aim two different pear gardens in Ula (Muğla: Turkey) and one pistachio garden in Suruç (Şanlıurfa: Turkey) was selected. Studies were conducted in 2021 from March to July. Pheromone formulation was used with some trap combinations. These combinations were: 1-yellow sticky traps 2- pheremone+yellow sticky traps 3- pheremone ((CacPyr Attractants for Psyllids) produced by Novagrica (France)) + delta traps. Pest populations were counted monthly on the combinations. It was seen that pheremone formulations were not as effective as yellow sticky traps. With the result of this study it is proved that the new pheromone preparation (CacPyr Attractants for Psyllids (Novagrica-France)) don't have hopeful effects to control of *Cacopsylla pyri* and *Agonoscena pistaciae*.

Key words: *Cacopsylla pyri*, *Agonoscena pistaciae*, yellow sticky trap.

INVESTIGATION OF INSECTICIDAL PROPERTIES OF SOME BORON-CONTAINING COMPOUNDS ON SOME PESTS OF GREENHOUSE CULTIVATION

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Abstract

This study was carried out to show the insecticide features of two different boron compounds (tarimbor and boric acid) so as to control main pesticides to tomato in greenhouses in the southern west town Ortaca (Muğla), Turkey from 2019 to 2021. Besides, the effects on fauna and the productivity was also shown in the study. When it comes the dose, world Health Organization (WHO) limits were essential. (TarimBor 20, 40, 80 ppm Boric Acid 2, 5, 10). Weekly applications and controls were done periodically. To see the beneficial fauna effects of boron compounds, yellow sticky traps were set up in every lot in every single greenhouse and countings were done. Seasonal tomato productions were listed to see the productivity effect of the compounds. Taking the results into consideration, 200 ppm dose for tarimbor can be used as both a pesticide and fertilizer. It has shown with the study, it has nearly zero negative effects on beneficial organisms and it increased the yield. Big campaign must be held to inform the farmers about using tarimbor compounds as an alternative to synthetic pesticides which brings the residue and environmental problems.

Key words: *Boricacide, tarimbor, parasitoid, greenhouse, tomatoes, pests*

CHARACTERIZATION AND COMPARISON OF THE TOXIC/IMMUNOLOGICAL POTENTIAL OF DIFFERENT WHEAT CULTIVARS FROM TURKEY

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Abstract

Wheat is part of the daily diet of millions of people throughout the world. The α -amylase/trypsin inhibitors (ATIs) are discussed as being responsible for non-celiac wheat sensitivity (NCWS), besides being known as allergenic components for baker's asthma. Samples were collected from selected regions of Turkey with different climates and from harvests of different years. Different approaches for characterization and quantification including proteomics-based methods for wheat ATIs have been documented. In these studies, generally the major ATIs have been addressed. Two extractions systems based on chloroform/methanol mixture (CM) and under buffered denaturing conditions were evaluated. Three aspects were optimized, tryptic digestion, chromatographic separation, and targeted tandem mass spectrometric analysis (HPLC-MS/MS). The analyzed wheat samples of the present study differ in their growing regions and in their harvest years. When comparing the total relative ATI contents between the wheat extracts of the C/M method, the much higher values for the durum wheat samples S10 (cultivar Pehlivan) and S20 (cultivar Esperya) are noticeable. The cultivar Siyazan of different regions shows remarkably low values, whereas all three samples are assigned to the same wheat species, namely common wheat. Finally, the developed LC-MRM-MS method has allowed the analysis of the main commonly analyzed wheat ATIs as well as ATIs that have not been reported in the recently documented analytical methods. Corresponding synthetic peptides for the established biomarker will allow absolute quantification in the following studies. Further work is directed to testing the effect of processing on the response of individual ATIs.

Keywords: *α -amylase/trypsin inhibitors, Wheat cultivars, SDS-PAGE, Peptides markers, Relative quantification.*

NATURAL ALTERNATIVE TO SYNTHETIC NITRITE: THE USE OF PRE-CONVERTED NITRITE IN MEAT PRODUCTS

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Abstract

Nitrite has historically been used in meat products for its biological and functional roles. Beneficial effects of the addition of nitrites to meat products are increased shelf life, improvement of quality characteristics as well as microbiological safety. The nitrates and nitrites are mainly responsible for the development of the distinct flavor, the stability of the red color, as well as the protection against lipid oxidation in cured meat products. It contributes to the development of characteristic color development and stability. Moreover, nitrite is a bacteriostatic agent that prevents the growth of *Clostridium botulinum* and spore germination. Despite many recent advancements in the meat industry, consumers continue to change preferences owing to health issues. In 2015, the International Agency for Research on Cancer identified processed meat products and red meat as possible carcinogens. Therefore, researchers have focused on developing processed meat products that are not harmful to health by eliminating synthetic nitrite additives or replacing them with natural materials. Nitrite is challenging to replace using simple antioxidants or antimicrobial substances because it can serve multiple functions. Food manufacturers have explored the use of vegetable powder, vegetable extract, and nitrite (NO_2^-) converted from nitrate (NO_3^-) with nitrate-reducing bacteria (pre-converted) as a substitute for synthetic nitrite. Natural nitrate sources origin (direct use of nitrate-containing vegetable powders or juices) could be used in long-ripened meat products, which allows converting nitrate to nitrite by microorganisms with nitrate reduction activity. However, in meat products that have short production processes and are heat treated, nitrate reduction will not be achieved due to the lack of sufficient time. Accordingly, industries prefer to use the 'cultured,' 'pre-fermented,' or 'pre-converted' nitrate-containing plant source, which has already been incubated with nitrate-reducing bacteria to produce nitrite. Pre-converted plant powder is simple to use because specific nitrites can be applied. Also, pre-converted vegetable products typically contain about 15,000–20,000 mg/kg of nitrite. This review briefly overviews pre-converted nitrite as a natural curing agent in meat products.

Keywords: *Pre-converted, Nitrate-reducing bacteria, Clean label meat products.*

EFFECTS OF EGGSHELL CALCIUM POWDER, PECTIN OR ACORN (*QUERCUS ILEX*) EXTRACT AS PHOSPHATE REPLACERS IN RESTRUCTURED TURKEY STEAKS

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Abstract

This study aimed to examine how well eggshell calcium powder (EC), pectin gel, or acorn extract (AE) can compensate for the functionality of phosphate in restructured meat products. Therefore, based on the presence of synthetic phosphate and the addition of natural phosphate replacer, the following turkey steak formulations were prepared: C (0.5% STPP), E (0.50 %EC), EP (0.50% EC+ 0.25% pectin gel), and EPP (0.50% EC+0.25% pectin gel+ 200 ppm gallic acid equivalent AE). The total amount of phenolic substances in the AE was found to be 45.69 mg gallic acid equivalent (GAE)/g. The addition of natural calcium powder and pectin gel as a binding agent increased the moisture content. The cooking yield of samples ranged between 85.88%-92.44%. Treatment formulated with 0.50% EC had the highest cooking yield, however, all reformulated samples had lower water holding capacity than C samples. Initial peroxide values ranged between 2.92- 10.89 meqO₂/kg. The lowest peroxide values were registered for C and E samples. As storage progresses, the antioxidant effect of pectin or pectin+AE was apparent, therefore the lowest peroxide value was found in EP and EPP samples. Initial values of TBARS were similar in C and EP, notwithstanding, lipid oxidation was more pronounced in EP samples after 3 months of storage. The addition of AE retarded the oxidation during the whole storage. Early on, E sample had the lowest carbonyl content while EPP had the highest, nevertheless, all samples had similar carbonyl contents after 3 months. Sulfhydryl content increased from 23.98-29.98 nmol sulfhydryl/mg protein to 36.10-57.06 nmol sulfhydryl/ mg protein. C and E treatments had the highest sulfhydryl groups at the end of the storage period while acorn extract had no effect on protein oxidation. Acorn extract was found more effective to oxidation in lipids than proteins. As a conclusion, EC and pectin gel were correspond the technological properties while acorn extract meets the antioxidant effect of synthetic phosphate against the lipid oxidation.

Keywords: *Restructured turkey steaks, Phosphate, Eggshell calcium powder, Acorn extract*

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APPLICATION OF ARTIFICIAL NEURAL NETWORKS IN THE PRODUCTION AND PROCESSING OF WHEAT

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Abstract

Wheat is a principal food crop for the global population, wheat is the most widely grown crop in the world, and its world trade is greater than all other crops combined. Concerning food security, it is the second most significant crop in the developing world. In the modern era, one of the most serious concerns that must be handled is global food security, which is encircled by climate change and a growing population while living in an already ill-affected environment. Taking the fact that wheat has the main role in the global food supply its production must be increased efficiently and sustainably. Application of data-driven approaches to enhance agricultural productivity, while minimizing environmental impact has arisen as new scientific fields in Agrotechnology. Artificial neural networks are one of the most important models of machine learning with the ability to solve many problems related to data. Its applications include prediction of production effects, classification of species and quality of production, disease detection, and weed control. Its applications support decision-making systems in agriculture to improve the cultivation, storage, and processing of products, and facilitate the managerial aspect of agricultural production. Currently, the considerable development of precision farming is driving agriculturalists to methods that make use of artificial intelligence. This article covers the role of machine learning, emphasizing the application of artificial neural networks in the production and processing of wheat.

Keywords: *Wheat, Neural Network, Data, Agriculture*

PESTICIDE APPLICATION TECHNIQUES IN PRECISION AGRICULTURE

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Abstract

Agriculture is a vital sector that is directly concerned with society when it is studied economically, socially and environmentally, because people provide raw materials to other sectors as well as life, employment. In order to meet the food needs of the world population, which will be approximately 9.7 billion in 2050, production must be increased by 70%. Agricultural practices carried out in order to meet the growing population food needs bring various risks and problems. In particular, unconsciousness in fertilizer and pesticides practices or technical inaccuracies in practice have impacted natural balance. Today, with the increasing importance of food and environmental awareness, precision agricultural techniques have become priority issues. Precision agriculture allows farmers to take advantage of the power of science and technology to provide optimal control, as well as increase land productivity with the use of technological tools. In precision agriculture, remote sensing geographic information systems and variable application technologies are used together. Precision agricultural applications enable use from soil processing to harvesting in the agricultural area. Reducing the risks from the point of view of food and the environment that may arise as a result of improper and excessive use of pesticides, improving the quality and efficiency of production are important issues that should be focused on. In precision agriculture today, pesticides are done with techniques such as unmanned aerial vehicle (UAV), Variable rate application technologies (VRA), geographical information systems, global positioning system (GPS). In this study, pesticides application techniques that have found the area of use within precision agriculture and are subject to research have been evaluated.

Keywords: *Precision agriculture, pesticide, pesticide applications, sprayer, food safety.*

TECHNOLOGICAL PROPERTIES OF MEATBALLS FORMULATED WITH DIFFERENT LEVELS OF DRIED TOMATO POWDER

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Abstract

In recent years, the development of functional meat products with properties that can promote well-being is one of the fastest-growing areas of research. Enhancing the functionality of meat products by adding natural additives rich in dietary fiber is a prominent strategy. Therefore, this study was carried out to observe the effects of using dried tomato powder (4%, 8%, and 12%) on some quality parameters of meatballs. The increase in the tomato powder (TP) ratio to 12% in meatball samples caused the moisture content of the samples to decrease. Protein amounts of the treatments were not statistically significant, while fat content was reduced by adding tomato powder. The fibers in the tomato powder swelled, thus, preventing moisture and fat release from the matrix and providing higher cooking efficiency. The addition of 4% TP did not affect fat retention while other inclusion levels resulted in higher retention of fat in the meat system. The incorporation of tomato powder had minimal changes in meatball diameters, treatments added with 12% TP and 4% TP had the lowest change in diameter and thickness, respectively. In the early stages of storage, the use of TP did not affect the TBA value, however, lycopene in the tomato powder was responsible for the lower TBA values in the later stages of storage. As a result, appropriate amounts of dried tomato powder could be a worthy attempt to entitle functional meat products without any detrimental effects on sensory properties.

Keywords: *Tomato powder, Meatball, Cooking properties, Oxidation*

UTILIZATION OF GELLED EMULSION BASED ON CHIA FLOUR WITH PEANUT OIL IN BEEF PATTIES

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Abstract

In this study, four different patty formulations were prepared where beef fat was substituted with gelled emulsion (GE) prepared with chia flour and peanut oil; C (0% GE), G50 (50% GE), G75 (75% GE), and G100 (100% GE). The effects of using GE on color parameters, oxidative changes, and sensory properties during 45 days of storage were investigated. The peroxide values of the samples increased until the 30th day, and the highest value (24.08 meqO₂/kg) was reached in the control samples (P<0.05). On the 45th day, a decrease was observed in the peroxide values of all treatments. While no differences were observed between the TBARS values on the 15th day of storage, the lowest TBARS values were observed on the 30th day in G75 and G100 treatments and the 45th day in G50 and G100 treatments. It was observed that the addition of GE to the formulation prevented lipid oxidation regardless of the amount (P<0.05). In general, while L* values decreased during the storage, b* values increased and a* values were found to fluctuate. Replacing beef fat with GE did not change the sensory properties and samples with GE were preferable to the panelists. In a conclusion, gelled emulsions prepared with chia flour and peanut oil could be considered a healthier fat replacer for meat products.

Keywords: *Chia, Gelled emulsion, Peanut oil, Beef patty, Fat replacer.*

THE PRESENCE OF PROTISTAN PATHOGENS IN SOME COLEOPTERAN STORED PESTS

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Abstract

Different climatic conditions and insufficient storage areas create very favorable environments for the development of many stored product pests. The protection of stored products is very important both to ensure food safety and to contribute to the country economy. The interest in the use of entomopathogens (EPOs) as an alternative to chemical insecticides in the control strategies against stored pests is increasing day by day. Among the entomopathogens, protistan pathogens play an important role as natural suppressor factor in pest insect populations. The present study includes presence of protistan pathogens in the populations of four important coleopteran stored pests, *Tribolium castaneum* (Hbst.), *Tribolium confusum* (Duv), *Oryzaephilus surinamensis* (L.) and *Oryzaephilus mercator* (Fauv.) from five localities in Turkey. During the study, 230 samples of coleopteran stored pests were dissected and searched for protistan entomopathogens. Two pathogens, microsporidium and coccidian were found in the different populations of the pests. While microsporidian pathogen was observed in the populations of *T. confusum*, *T. castaneum*, *O. mercator* and *O. surinamensis* (Bursa, Samsun and Gaziantep locations) coccidian pathogen was observed in only one population of *T. confusum* (Bursa location). The infection rates were relatively low, 4.35% for microsporidian and 0.43% for coccidian pathogens. Total infection level was found as 4.78%. However, infection reached to 9.25% in some populations. The present study includes the first records on the prevalence of protistan pathogens in the populations of coleopteran stored pests from five localities in Turkey, however it is needed to increase the number of coleopteran species and samples and populations from different locations to represent the entire Turkey. Furthermore, it is needed to investigate other pathogens and parasites and identify each of them at the species level.

Keywords: *Stored coleopteran pests, Microsporidia, Coccidia, Biological control, Turkey.*

UTILIZATION OF GELLED EMULSION BASED ON CHIA FLOUR WITH PEANUT OIL IN BEEF PATTIES

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Abstract

Gelled emulsions can offer a better option than simple oil-in-water (O/W) emulsions to achieve higher oxidative stability and better physicochemical properties apart from contributing to functional properties. In this study, four different patty formulations were prepared where beef fat was substituted with gelled emulsion (GE) containing chia flour and peanut oil; C (0% GE), G50 (50% GE), G75 (75% GE), and G100 (100% GE). It was aimed to investigate the effects of using gelled emulsions on color parameters, oxidative and sensory properties during 45 days of storage. The peroxide values of the samples increased until the 30th day, and the highest value (24.08 meqO₂/kg) was reached in the control samples (P<0.05). On the 45th day, a decrease was observed in the peroxide values of all treatments. This decrease was due to the conversion of lipid peroxides to other lipid or protein oxidation products. While no differences were observed between the TBARS values on the 15th day of storage, the lowest TBARS values were observed on the 30th day in the G75 and G100 samples, and on the 45th day in the G50 and G100 samples. It was observed that the addition of chia gel emulsion to the formulation prevented lipid oxidation regardless of the used amount (P<0.05). The effect of using gel emulsion on color parameters was significant (P<0.05). In general, while L* values decreased during the storage, b* values increased and a* values were found to fluctuate. Replacing beef fat with gelled emulsion did not have a negative effect on the sensory properties of the samples, and even higher sensory scores were obtained in reformulated samples than control (P<0.05). It was observed that samples with GE were preferable by the panelists especially in terms of juiciness, oiliness, textural and flavor. As a conclusion, gelled emulsion prepared with chia flour and peanut oil could be considered a healthier ingredient in meat products.

Keywords: *Chia, Gelled emulsion, Peanut oil, Beef patty, Fat replacer*

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SCREENING FOR RECOMBINANT ISOLATES OF POTATO Y VIRUS IN TURKEY

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Abstract

There are many pathogroup of Potato Y virus (Potato Y potyvirus, PVY) and although there are many studies done in the world, there are few studies on the detection of the virus at the national level in Turkey. In this study, the molecular determination of PVY, which causes serious product and yield losses in important potato production areas, and the presence of recombinant and non-recombinant pathogroup of PVY in our country were investigated. For this purpose, surveys were carried out in Afyon, Bolu, Nevşehir and Tokat provinces and leaf samples were taken from a total of 447 potato plants showing virus symptoms. As a result of RT-PCR studies with coat protein (CP) region specific primer to determine the presence of PVY, 196 samples (43.8%) were found to be infected with PVY. In order to detect PVY pathogroups according to different protein regions by RT-PCR, RT-PCR and the phylogenetic analysis were performed according to P1, HC-Pro and P3 regions, which are different protein regions of PVY. As a result of phylogenetic analysis, pathogroup N-Wi were commonly found in potato plants (35/40 samples). A small amount (5/40 samples) of pathogroup PVY^{NTN} was detected. In recent studies, it has been reported that non-recombinant isolates of PVY are rapidly replaced by recombinant isolates of the virus. Similarly, in this study only recombinant isolates were detected in potato fields in Turkey, and non-recombinant isolates were not detected.

Keywords: *coat protein, potyvirus, potato, p1 region, pathogroup.*

UV DOSE DETERMINATION ON FOOD SURFACES BY IMAGE PROCESSING TECHNIQUE

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Abstract

UV light is a nonionizing radiation source. UV treatment has been used for disinfection of airborne microorganisms, sterilizing liquids, and disinfection of surfaces of solid foods and food contact materials. The determination of UV dose on food products or surfaces is challenging. Some techniques such as radiometry, actinometry, and biodosimetry can determine irradiance. Then, the UV dose (UV fluence) is calculated from irradiance and the exposure time. These techniques have some shortcomings and advantages, but they do not give precise results in processing irregularly shaped food surfaces. Radiochromic films used in food radiation applications and other radiology fields can be an alternative tool for UV dose determination on food surfaces. The study established a relationship between the color change in the radiochromic films placed on the food surface (apple) and the UV dose using the color vision system (CVS) based on the image processing method. Finally, an alternative method for determining the UV dose applied to the food surfaces was presented. The results were compared with those chroma-meter measurements and the actinometric method. It was revealed that there is a linear correlation between the color change of RCF and UV dose. The maximum UV dose that could be determined using RCF at 254 nm was approximately 60 mJ/cm². The shape of the apples resulted in different UV dose distribution profiles on the surface. As a result, it has been demonstrated that RCFs can be successfully used to determine UV dose on sample surfaces. It was found that the films were stable at room and refrigerated conditions.

Keywords: *Food surfaces, UV-C light, radiochromic film, actinometric method.*

EFFECTS OF OXALIC ACID TREATMENTS ON POSTHARVEST QUALITY AND STORAGE LIFE OF APPLE CV. GRANNY SMITH

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Abstract

Oxalic acid is a natural organic natural compounds are present in fruits and vegetables, and have shown important roles in delaying the ripening process when applied as postharvest treatment. In this study, effects of different concentrations of oxalic acid (OA) on storage and postharvest quality of 'Granny Smith' apples were investigated. Apples were dipped in different concentrations OA (2 mM, 4 mM and 6 mM) solutions for ten minutes, while control fruits were immersed in distilled water for the same minutes. Treated fruits were stored at 0 °C and 90% relative humidity for 4 months. Weight loss, firmness, skin color (hue angle), total soluble solid content (SSC), titratable acidity (TA), pH and starch were performed with 30 d intervals during the storage time. According to the results, all oxalic acid treatments maintained firmness, skin hue angle and titratable acid. It was determined that oxalic acid treatments were effective on the preservation of quality characteristics in Granny Smith apple compared the control. During cold storage, the lowest weight loss was determined in 4 mM OA treated fruits. It was concluded that the applied doses gave similar results in general, but 4 mM oxalic acid application could be the appropriate dose for cold storage of Granny Smith apple, especially in reducing weight loss, fruit firmness and maintaining titratable acidity values. For this reason, 4 mM OA treatment was considered to be effective on quality extension of apples *cv.* Granny Smith with decreasing the quality changes of during cold storage.

Keywords: *Apple, Granny Smith, postharvest quality, oxalic acid.*

PREDICTION OF MICROBIAL INACTIVATION IN UV LIGHT TREATMENT OF WHITE TEA USING MACHINE LEARNING AND NEURAL NETWORKS

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Abstract

The potential of ultra-violet (UV) light to replace the traditional brewing process to make cold tea in terms of inactivation of endogenous microflora has not been explored. Thus, the efficacy of emerging technologies such as UV-C by tea leaves/water ranging from 1 to 3 %, number of lamps ranging from 2 to 8, and number of cycles ranging from 4 to 8 were performed to determine the inactivation of total mesophilic aerobic bacteria (TMAB) and total mold and yeast (TMY) and changes in quality properties in cold drip white tea. The UV-light process was effective to reduce both TMAB and TMY. Increased number of cycles provided a significant amount of inactivation on both TMAB and TMY. The reduction of initial number of TMY was determined as 3.40 ± 0.03 log cfu/mL with the number of lamps of 5, the number of cycle of 4, and tea leaves/water ratio of 1%, whereas TMAB were found as 3.12 ± 0.08 log cfu/ with the number of lamps of 2, the number of cycles of 6 and tea leaves/water ratio of 1%. The resulting datasets were used to predict the inactivation of TMAB and TMY in cold drip white tea using gradient boosting regression tree (GBRT), random forest regression (RFR), and artificial neuron network (ANN) models. The ANN model provided the lowest RMSE and highest R^2 value for predicted inactivation of TMAB. TMY has not been predicted using either machine or neural networks. UV treatment possess a viable alternative for microbial inactivation without adverse effect on the quality properties of cold drip white tea.

Keywords: *Ultraviolet light, Cold drip white tea, Total mesophilic aerobic bacteria, Machine learning*

EFFECTIVENESS OF PULSED ELECTRIC FIELD TREATMENT AND PLANT ESSENTIAL OILS ON QUALITY AND SHELF-LIFE EXTENSION OF LICORICE ROOT DRINK

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Abstract

Licorice root drink (LRD) is one of the most popular traditional drinks in Turkey which is usually consumed in summer seasons. It has very short shelf life, and thus, studies are in need to extend its shelf life. Plant essential oils (EO) have been used as natural food additive, but due to their strong flavor and aroma, their use in food is limited. Pulsed electric field (PEF) treatment is defined as the application of high intensity electric field pulses at the magnitude of 20-80 kV/cm for food pasteurization. Although effectiveness of EO and PEF alone or in combination for the preservation of different food are reported, they lack information on preservation and shelf-life extension of LRD. Freshly prepared LRD samples were divided into four group i-control, ii-*Mentha piperita* EO added, iii-PEF-treated and iv-*M. piperita* EO added+PEF-treated samples. Control and *M. piperita* EO added samples were spoiled by the 3rd week; whereas PEF-treated and *M. piperita* EO added+PEF-treated samples had the shelf life of six weeks. Although pH, conductivity, turbidity, color (L*, a* and b*), total antioxidant capacity, and total phenolic substance content of the samples fluctuated during shelf life, numbers of total mesophilic aerobic bacteria and total mold and yeast were significantly lower for PEF-treated and *M. piperita* EO added+PEF-treated samples. These samples also had higher sensory scores for the measured properties. Results revealed that PEF-treatment alone and *M. piperita* EO+PEF treatment were effective to extend shelf-life of LRD.

Keywords: *Pulsed electric fields, Licorice root drink, Shelf-life, Plant essential oils, Microbial inactivation*

BIOACTIVE COMPOUNDS OF BUTTER

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Abstract

Milk and dairy products are integral part of human nutrition and they are considered as the carriers of higher biological value proteins, calcium, essential fatty acids, amino acids, fat, water soluble vitamins and several bioactive compounds that are highly significant for several biochemical and physiological functions. When milk fat is churned, the membrane surrounding the fat globules is disrupted and the free fat released from the globules coalesces. results in a solid fat phase, namely butter. Thus, butter is a water-in-oil emulsion consisting of fat up to 82% and an aqueous phase up to 20% containing salt and milk solids not fat. Butter is made from cow milk (3 to 4% fat) that is converted first to cream (30 to 45% fat) by centrifuge. Functionally, fatty acids are precursors of a variety of bioactive lipid molecules. For example, arachidonic acid is the precursor of eicosanoids which function as signaling molecules through specific receptors and play important roles in inflammatory processes. High intakes of particular omega-3 fatty acids which include conjugated linoleic acid (CLA) can assist in the ailment and disorder prohibition and help in maintaining and control of metabolism in humans, manage plasma TG and cardiovascular functions, decreasing and lowering cancer, as well as obstructing tumor growth and metastasis from breast cancer. Owing to their important biological activity as major components of biological membranes, glycerophospholipids have been associated with various conditions such as cardiovascular diseases, cognitive and memory problems, inflammatory processes, diabetes and cancer.

Keywords: *Butter, water-in-oil emulsion, bioactive compounds, bioavailability.*

BIOACTIVE COMPOUNDS OF OLIVES AND THEIR BIOAVAILIBILITY

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Abstract

Olive oil, the main lipid source in the Mediterranean diet, is a functional food that has a high level of monounsaturated fatty acids (MUFAs) and contains several minor components with biological properties and it is high nutraceutical potential food. Dietary saturated fatty acids with predominantly mono (MUFA) and/or polyunsaturated (PUFA) fatty acids can improve serum lipid profile considerably. Olive oil is rich in monounsaturated fatty acids (MUFAs), mainly oleic acid (47–84%) and polyunsaturated fatty acids (PUFAs), linoleic (3.5–21 %) and linolenic acids (<0.1%) are bioactive lipids with anti-inflammatory and/or pro-resolving activities. Moreover, the co-presence of phenolic compounds and vitamins (tocopherol etc.,) in olive oil may prevent the development of chronic diseases by their anti-inflammatory, antioxidant, neuroprotective, and immunomodulatory activities. The positive correlations between the daily intake of phenolic compounds in the Mediterranean diet and health was demonstrated. European Regulation EU 432/2012, 2012, EFSA, 2012 claim on olive oil containing 5 mg hydroxytyrosol has increased the interest on the consumption of olive oil. The minor components, including phenolic compounds, α -tocopherol, phytosterols, carotenoids, chlorophylls, and squalene, which may be present up to 2% by weight have protective and antioxidant effects. Virgin olive oil contains a high amount of phenolic compounds that are crucial for its nutritional and organoleptic properties, as well as for the high oxidative stability, in comparison with other edible oils. Additionally, the level of these substances is a very important parameter for the quality of EVOO, mainly its organoleptic characteristics including flavor, astringency, pungency, and bitterness. The main antioxidants of EVOO are carotenoids, tocopherols, and other phenolic compounds, both lipophilic and hydrophilic. The lipophilics include tocopherols, while the hydrophilics include flavonoids, phenolic alcohols and acids, secoiridoids, and their metabolites. The major phenolic compounds present in olive oil are flavones, phenolic acids and derivatives, phenolic alcohols, secoiridoids and lignans. Polyphenols, play an important role on oxidative distress, telomere length and successful aging, by just modulating redox function. Studies have been applied in vivo (to humans and animals) and in vitro (via gastrointestinal digestion studies and cell culture studies) to determine the bioavailability of olive oil. A high content in mono-unsaturated fatty acids may improve the serum lipid profile and decrease the alterations caused by the oxidized low-density lipoproteins and free radicals. Mediterranean diet's healthy effects can in particular be attributed not only to the high relationship between unsaturated and saturated fatty acids in olive oil but also to the antioxidant property of its phenolic compounds. These compounds possible beneficial effects are due to their antioxidant activity, which is related to anti-inflammatory, antioxidant and anticancer activity

Keywords: *Olives, phenolics compounds, bioactive compounds, bioavailability*

SEED-BORNE AND SEED-TRANSMITTED VIRAL DISEASES AND THEIR EFFECT ON YIELD OF DIFFERENT SOYBEAN GENOTYPES

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Abstract

In 21st century soybean is a strategic legume for world agriculture. The key factor in increasing soybean production is the average yield growth, which in 2018 and 2021 in Ukraine was 3 t/ha as in the EU. From 2007 to 2017 the soybean yield in Ukraine was 2 t/ha; from 1997 to 2006 it was only 1 t/ha. Unlike, in the EU since 1999 the yield was 3 t/ha, and only in 2003, 2007 and 2012 it was 2 t/ha. For Ukraine not the least role in this situation is played by the reduction of quality of soybean sowing material due to seed infections. It is known that the quality of soybean seeds is significantly deteriorating due to infection by soybean mosaic virus (SMV), which circulates in all soybean growing regions worldwide. The aim of the study was to investigate SMV seed infection in sowing material and its effect on the yield of different soybean genotypes. DAS-ELISA showed SMV presence in a small seeds fraction of several soybean genotypes in both seedlings (embryos and cotyledons) and plants grown from this seeds. The weight of virus-infected seeds was 137 mg compared to healthy (204 mg). It was found that the percentage of seed-transmitted SMV infection is from 2 to 10% in some of investigated genotypes. It has been proven that seed spotting does not always indicate the presence of virus. Phylogenetic analysis of the SMV *CP* gene fragment was performed. Percent of nucleotide and amino acid sequence identity of Ukrainian SMV isolate with isolates from other countries was established.

Keywords: *soybean, genotypes, soybean mosaic virus, seed infection.*

ORGANIC AGRICULTURE

MODE OF ACTION OF FLUORESENT PSEUDOMONAS AS PGPR AND POTENTIAL FOR THEIR USE AS BIOLOGICAL CONTROL AGENT AGAINST VERTICILLIUM WILT OF TOMATO (LYCOPERSICUM ESCULENTUM MILL.)

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Abstract

Pseudomonas spp. fluorescents fit into the context of biological control that can be considered as a potential alternative to chemical control. The studies we conducted aimed initially selecting strains of *Pseudomonas* spp. fluorescent antagonists to verticillium wilt disease of tomato caused by *Verticillium dahliae* and a second time in the evaluation of the influence of certain strains in the plant growth. We have a collection of 14 strains of *Pseudomonas* spp. fluorescent isolated from the root rhizospheric soil of healthy tomato plants, which have demonstrated their *in vitro* antagonistic activities against *Verticillium dahliae* by direct and indirect confrontation and the production of some secondary metabolites such as nitrogen fixation, phosphorus mobilization, and indol acetic acid production (AIA). The effectiveness of selected strains was then assessed in pots under green house conditions. The impact of verticilliose was slowed after the bacterization of the roots of tomato plants with 10⁸UFC/ML of bacterial suspension. The ability of the four best isolates named Pf1, Pf2, Pf3 and Pf4 to protect tomato plants against *Verticillium* wilt was confirmed. Disease incidence was reduced by 80% in the Pf1 strain, followed by the Pf4 strain with a percentage of 73% and the Pf2 and Pf3 strains with reduction percentages of 70.33 and 66.66% respectively. PGPR effect relative was noted; especially in the early stages of the culture and their ability to stimulate the elements of growth for the plant is confirmed during the growth process which is principally in the primary stage.

Keywords: *Verticillium dahliae* - Tomato - Antagonism - Biocontrol - *Pseudomonas* spp

**NATURAL PLANT PRODUCT INCREASES THE EFFICACY OF MICROBIAL
ORIGIN INSECTICIDES TO CONTROL EGGPLANT SHOOT AND FRUIT BORER,
LEUCINODES ORBONALIS GUENEE AND YIELD**

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Abstract

Brinjal shoot and fruit borer (BSFB) is a notorious insect pest causing a significant yield loss in Bangladesh. To address this issue, study was conducted with bacteria origin insecticide Emamectine benzoate and Abamectin along with natural plant extract 'Fytoshine' in a combination. All the insecticides successfully control BSFB, but Emamectin benzoate 1% + Fytoshine and Abamectin 1.8% + Fytoshine were found most potent providing 89.34% and 81.55% shoot infestation control. Same insecticides were found effective for fruit infestation reduction where Emamectin benzoate 1% + Fytoshine provided 93.34% and 94.91% control by number and weight basis, respectively whereas Abamectin 1.8% + Fytoshine provided 85.11% and 85.27% control by number and weight basis, respectively. Maximum marketable yield was confirmed by Abamectin 1.2% + Fytoshine (2.32 ton/ha/harvest) and Abamectin 1.8% (1.84 ton/ha/harvest). For gross yield, Abamectin 1.2% + Fytoshine (2.72 ton/ha/harvest) and Abamectin 1.8% (2.06 ton/ha/harvest) were found effective. Maximum individual fruit weight was produced by Abamectin 1.2% + Fytoshine (44.12g) and Abamectin 1.8% (43.68g) for infested fruit. Same for the marketable fruit was produced by Abamectin 1.2% + Fytoshine (47.30g) and Emamectine benzoate 1% (46.49g). Therefore, Emamectin benzoate 1% + Fytoshine and Abamectin 1.8% + Fytoshine were found potent for BSFB control while Abamectin 1.2% + Fytoshine and Abamectin 1.8% were found effective to increase the marketable yield.

Keywords: *Leucinodes orbonalis* G., Brinjal, Emamectine benzoate, Abamectin, Fytoshine.

EFFECT OF HARMFUL AGENT ON PRODUCTION, INCOME AND BIODIVERSITY OF SHRIMP FARMING IN BANGLADESH

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Abstract

Shrimp is one of the leading exportable seafood products from where Bangladesh is earning about US\$ 500 million yearly contributing 3.78% to the GDP. Shrimp farmers follow the traditional and extensive farming practices and the average production is 275 kg/ha which is the lowest compared to other shrimp producing countries around the world. Reasons of this low production are lack of better technology, death of quality seed and feed, and effect of shrimp disease. Small-scale organic shrimp farming practice introduced recently, has shown better production and profitability in four coastal sub districts (Upazila) of Sathkira district in the southwest part of the country. Three different farming practices were studied: (i) organic (ii) traditional and (iii) extensive or control farming where farmers were interviewed to collect different data. The data shows that organic farmers are producing 10.64% higher than the traditional farmers and 20.84% higher than extensive or control farming systems. Cost-benefit analysis showed that organic farming is more profitable compared to other practices because of low input cost and premium price received for organic shrimp. Percentage of gross sale of organic cultured shrimp is 10% higher than traditional and 19.37% higher than control or extensive shrimp farming. It is also found that the organic production (kg/ha) is little bit higher than the control and the traditional farming practices. On the other hand traditional farming production cost is higher than the organic and control production. Considering the biodiversity conservation, organic farming is more ecofriendly culture system than control and the traditional practices.

Keywords: *Harmful agent, Production, Income, Biodiversity conservation, Shrimp farming practice, Bangladesh*

CONTENT OF MINERALS IN APRICOT FRUITS FROM THE URBAN AREA OF THE CITY OF MOSTAR, BOSNIA AND HERZEGOVINA

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Abstract

Apricot cultivation in the area of the city of Mostar has a long tradition. With the urbanization of the city in the early 1960s, larger cassia plantations disappeared, but individual trees remained in a large number of private backyards. The aim of this study was to examine the content of mineral substances in apricot fields from the urban area of the city of Mostar. For that purpose, three localities in the urban zone of the city were, Brankovac, Mazoljice, and Donja Mahala. All three tree sites from which the samples were taken were of different ages. Analysis of the content of K, Ca, Mg, Fe, Zn, Na, and Cu was performed by the method of atomic absorption spectrophotometry in the reference laboratory of the Federal Agro- Mediterranean Institute in Mostar. Since, according to our information, similar tests on apricot fruits from the area of Herzegovina and the City of Mostar have not been done so far, the obtained results are compared with the literature data. The results showed that the content of Na and Cu is extremely low, while the content of Fe is extremely high in relation to the reference value. The influence of localities, actually the age of the tree, on the content of K, Ca, Mg, and Fe showed statistical significance. The influence of localities on the Zn content had no statistical significance, and since the sodium and copper content was extremely low, they could not serve as a statistical feature.

Keywords: *cultivar, locality, mineral matter, concentration, statistical analysis*

BLACK RASBERRY (*Rubus occidentalis* L), A NEGLECTED MINOR FRUIT CROP

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Abstract

Wild black raspberries are native to North America. Their commercial cultivars were first introduced to our region in the 1960s, but their production practice did not accept them, for certain reasons. Today, there are three cultivars on the official List of Cultivars of Bosnia and Herzegovina (B&H), of which the *Rubus occidentalis* L. 'Cumberland' was observed. The aim of this work is to analyze the chemical composition of its fruits, together with some of the pomological properties and to compare these parameters with the cultivated and wild berries. Samples for analysis come from a private organic plantation at the Šnjegotina Donja site, 45 km from the city of Banja Luka, B&H. The diameter and weight of the fruit were measured on a representative sample. The average fruit diameter was 11.6 +/- 1.31 mm (Δ 8-13 mm) and the average fruit weight was 0.857 +/- 0.176 g (Δ 0.55-1.62 g). These values are slightly smaller than those of wild (red) raspberry (*Rubus idaeus* L.), and are inferior to the size of commercial raspberry cultivars. In terms of basic chemical composition, it was determined that black raspberry 'Cumberland' has the highest content of dry matter (19.57%), ash (0.96%) and vitamin C (19.09 mg/100g_{F.W.}) among fruits investigated. In terms of total sugars, 'Cumberland' (7.41%) is significantly above blackberries (2.71-5.38%), and only slightly below raspberry 'Willamette' (7.85%). Elemental concentrations (mg/100g) ranged from 480.76±1.90 (K) to 0.51±0.01(Mn). 'Cumberland' contains the most K, Ca, Mg and Cu among the observed taxa. The concentrations of K, Ca and Mg, which are twice as high as in other species, stand out. Regarding the content of Fe, Mn and Zn, 'Cumberland' is not significantly behind the maximum values of other observed taxa. Cadmium, chromium and lead were not detected at all, while copper (0.22 ± 0.04 mg/100g) and zinc (0.46 ± 0.02 mg/100g) had no illicit concentrations. Regarding phytochemicals and antioxidant activity of fresh berry fruits, 'Cumberland' contains: 9.67 µgGAE/mg_{F.W.} of phenols, 2.41 µgQcE/mg_{F.W.} of flavonoids, 36.53 µg/mL_{F.W.} of anthocyanins. Also, in both tests (ABTS & DPPH), the highest antioxidant activity, i.e. the strongest ability to act as radicals scavenger was performed by black raspberry 'Cumberland'.

Keywords: *black raspberry, variety 'Cumberland', pomological properties, chemical composition, antioxidant activity*

GINKGO LEAVES AND YEW ARILS – USABLE PARTS OF OLD PLANT SPECIES (*Ginkgo biloba* L. et *Taxus baccata* L.)

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Abstract

The aim of this paper is to analyze the chemical composition, the contents of selected elements and sets of fatty acids in *Ginkgo* leaves and yew arils. Although *Ginkgo* (*Ginkgo biloba* L.) is deciduous and yew (*Taxus baccata* L.) is an evergreen, these species share several common characteristics: both are gymnosperms, both are very old species, both species are *dioecious* and both species are unusually resistant to disease and pollution. Also, today there are more of their individuals in cities than in forests. *Ginkgo* and yew have undoubted aesthetic properties, which is why they are welcome in our parks, alleys, gardens and other green places. In addition to their aesthetic merits, parts of both species have certain useful values. In this paper, we focused on two products - *Ginkgo* leaf and yew aril. *Ginkgo* leaf is considered one of the most commonly used herbal medicine in the world. On the other hand, the yew aril does not appear on the market as a commodity and only a relatively small number of people are familiar with its medicinal and edible potentials, especially since all other parts of the yew are poisonous to humans and most other mammals. The material for the analysis was collected in the area of the city of Banja Luka, B&H. In terms of chemical composition, *Ginkgo* leaf contains an average of 36% dry matter and yew arils 21.5%. We found that magnesium is the most abundant element in the *Ginkgo* leaf (Mg – 176.8 mg/100 g), while in the yew aril it is sodium (Na – 64.4 mg/100 g). Related to elemental composition, no increased level of toxic elements due to urban pollution was found in the analyzed material. A significant concentration of vitamin C has been determined in the *Ginkgo* leaf (18.7 mg/100g), which is not at all behind some well-known types of fruit. The same applies to total sugars in yew aril (15.61%). Also, in *Ginkgo* leaves 21 fatty acids (FAs) were detected, of which 11 were saturated (SFAs) and 10 unsaturated (USFAs). SFAs participate with 41.98% and USFAs with 58.02%. The most common among SFAs is stearic FA with a share of 29.53%. The most common USFA is γ -linolenic with a share of 13.31%. This study also showed that the average weight of fresh yew fruit is 0.65 g, of which 86.7% is the aril and 13.3% is the seed.

Keywords: *Ginkgo* leaves, yew arils, chemical composition, fatty acids

EVALUATION OF SOIL QUALITY INDICATORS IN ORGANIC FERTILIZATION AS AN ALTERNATIVE TO SUSTAINABLE AGRICULTURE

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Abstract

Sustainable agriculture is the yield for agricultural products with good quantity and quality, but with care for the soil in the future. Nowadays, agriculture practices have led to humus reduction in the cultivated soil layer, even in sustainable soils. Applying the principles of the circular economy, composting and organic fertilization are ways to increase the organic matter in the soil. However, whether entirely organic fertilization is an alternative to sustainable agriculture is the aim of this article. The following soil quality indicators are assessed – pH; content and composition of soil organic matter (SOM); total nitrogen; C:N, and mobile forms of nutrients - NPK. The results present vegetation experience with two scenarios. The first scenario is with Luvisol (LV) and the second with Fluvisol (FL). Each scenario has an addition of various organic ameliorants. The period of the experiment covers the composting period and two vegetation cycles - lettuce and spinach aftereffect. The evaluation is against control variants and limits values. The two soils have different physicochemical characteristics. Luvisol has a higher total carbon content and total nitrogen than Fluvisol. In the end, the 1st soil has increased the SOM up to 4% compared to the second soil, where the improvement is no more than 2%. Accordingly, the nitrogen content is higher in Luvisol than in Fluvisol. In conclusion, we can say that organic fertilization alone is not an alternative to sustainable land management principally because nitrogen depletes after the first growing season in both scenarios of the experiment.

Keywords: *manure, composting, organic carbon, NPK, vegetation experience.*

PLANT BREEDING FOR ORGANIC AGRICULTURE: A SWOT ANALYSIS

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Abstract

Organic farming is a fast growing niche within the entire agricultural production. However, it is not aimed to replace conventional, i.e. industrial system of production, but is developing within the limited frame of holistic approach, and is based on specific values and principles, such as the principle of health, the principle of ecology, and the principle of overall sustainability, care and fairness. As a consequence of these principles, organic farming poses requirements on plant breeding programmes different from conventional breeding regarding their strategies, goals, techniques, resources, and legislative procedures. In such an environment, plant breeding for organic agriculture has several strengths and weaknesses as an internal driving forces or constraints, but is also exposed to external threats and opportunities. Here we present overview of the most important SWOT factors and forces that determine strategies of plant breeding activities and programmes for organic agriculture, and their comparison with the mainstream breeding procedures in conventional breeding programmes. The stress in this analysis is put on the differences that seems to put the organic breeding putatively ‘‘a step back’’ in regards to mainstream breeding, such as differences in genetic resources used, techniques applied, traits favoured, and goals to be achieved in cultivar design for organic agriculture as the factors that should be considered in order to achieve ecological, technological, and social sustainability of this specific agricultural niche.

Keywords: *strategy, breeding goals, variety, breeding programmes, genetic resources*

IMPACT OF USING ALGA FOR WASTEWATER BIOLOGICAL TREATMENT

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Abstract

Water is a limited resource that mankind should cherish. Water resources are the critical factor affecting production, services, and sustainable development. Drainage water reuses was included in the “Egyptian Water Policy” in order to bridge the gap between supply and demand. The research was aiming at the biological treatments by alga for drains water reused as well as producing the green algal biomass. Water samples used for treatment were collected from Om El-Resh Drain and treated by *Chlorella vulgaris* alga. The research performance for drains water treatment by algae was through four sequenced steps: first, alga was grown in original wastewater comparing with original growth medium; second; wastewater was enriched by nitrogen; third wastewater was enriched by phosphorous and fourth step; include the enrichment of wastewater by nitrogen and phosphorous at the same amount of BG-11 growth medium to select the best method of treatment in concern nutrient enrichment. The research results showed that the best treatment was when treating wastewater by alga with nitrogen and phosphorus together after 48 hours. In addition, the maximum percent reduction was 97.58, 96.71, 87.38, 91.73 and 90.50% for nitrogen, phosphorous, potassium, sodium and calcium, respectively. Whereas, the maximum removal percentage for BOD and COD by *Chlorella vulgaris* were reached to 86.67% and 84.44 %, respectively. The results indicated that most of such aforementioned treatment led to completely disappearing of total and fecal coliform and their lowest count percent was reached 96.48%.

Keywords: *Drains; Wastewater; Algae (Chlorella vulgaris), Biological treatment.*

EFFECT OF RESIDUES AND FRESH EXTRACT OF MEDICINAL PLANTS ON SOIL NUTRIENTS AND *ZEA MAYS* L. YIELDS

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Abstract

The aim of this study was to study the nutrients status of soil and *Zea mays* plant and the effect of allelochemicals of powder and extract of medicinal plant (*Origanum vulgare* L. and *Melissa officinalis*) as well as microbial inoculation (Mycorrhiza and PGPR) on plant and soil. Each experiment was done as a factorial, the first factor in two levels (including plant extracts and powders as 2%) and the second factor in three levels (including Mycorrhiza and PGPR inoculation and control) in a completely randomized design. The results showed that the allelochemical effects of medicinal plants on root colonization and the nutrients concentration in soil and plants were different. However, the effectiveness of *Origanum vulgare* L. was significantly different than *Melissa officinalis*. Also, the allelochemical effect of fresh plant extract was higher than dry powder of medicinal plant on the nutrients concentration in soil and plants. Thus, the greatest impact was observed in declining the concentration of phosphorus (P) and zinc (Zn) and the least was in soil potassium (K). Decreasing of phosphorus and zinc concentrations in treatment with *Origanum vulgare* L. extract was 35.9% and 50.6%, and in *Melissa officinalis* extract was 12 and 35.6% respectively. Root colonization was decreased in the *Origanum vulgare* L. and *Melissa officinalis* extracts uninoculated treatments by 43.5% and 48.4%, and dry powder treatment by 14% and 18.9% respectively. On the other hand, microbial inoculation improved the nutrient status of the soil and plants, and significantly prevented the reduction of measured traits. As a result, medicinal plant residual resulted in decreasing available forms of nutrients for the target plants, or possible inhibition of the nutrient uptake by the roots. So, microbial inoculation was the best strategy and it prevents a severe decrease in the concentration of nutrients to deal with this condition.

Keywords: Allelopathy, Allelochemical of medicinal plants, Nutrients uptake, PGPR, Mycorrhiza.

PEER LEARNING AND KNOWLEDGE CO-CREATION IN ORGANIC AQUACULTURE: THE CASE OF FutureEUAqua PROJECT

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Abstract

Organic aquaculture represents the 4.6% of total aquaculture production. Yet, the economic performance of EU organic aquaculture seems far from being satisfactory. Notwithstanding the above, Europe is still heavily dependent on external markets to cover seafood demand. Nowadays, fisheries and aquaculture sectors require paramount need to (i) enhance knowledge sharing and co-creation, (ii) set up appropriate infrastructures and facilities and (iii) increase capacity building for experts and practitioners. In order to overcome these needs an “active and participative” training method that allow participants to fully learn news concepts, while improving skills and capabilities, could be adopted. One of the most profitable methods is known as “Peer learning”, a form of collaborative instruction that enhances the peer-to-peer interaction and positive learning. In this context, under the framework of FutureEUAqua Project - increased capacity, CIHEAM Bari has designed and facilitated an online training program on “Sustainable, resilient and climate friendly Blue Growth of EU Aquaculture and beyond”. The 6-week course, structured in four modules, involved 357 participants coming from 77 countries: mainly from Europe and Mediterranean region (60%). Due to the dropout phenomena, circa 50 participants reached the threshold score to get the certificate. Furthermore, the training resulted in promoting the sustainable growth of aquaculture among involved stakeholders, to meet future challenges considering the growing consumer demand for high quality, nutritious and responsibly produced food. The outcomes of the course attempted also to increase the awareness of the sector, creating a community of practice where peers shared their technical and social knowledge with the final scope to transform project results and outputs, when implementing the innovative solution identified and developed, into practical knowledge. It may be concluded that adopting appropriated technology for eLearning and innovative educational approach may fill the gap of knowledge transfer under disruptive circumstance (i.e. COVID-19 pandemic).

Keywords: *Educational Innovation, Communities of Practices, Blue Growth, EU*

USE OF BIOSTIMULANTS TO PROMOTE GROWTH OF YOUNG OLIVE TREES

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Abstract

Organic Agriculture is a production system that sustains the health of soils, ecosystems, and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. In 2019-2020 trials were carried out to evaluate the effects of an organic fertilizer (Grena “olivo special”) and two biostimulants (“Idrogrena” and “Idrogrena Energy”) on the growth and physiology of young olive trees. Growth was estimated in terms of increase in diameter of the main stem and of the total height of the trees. The experiments were carried out using both potted and field grown trees. The effects of the organic fertilizer, also reported to have a biostimulant action, and two biostimulants were evaluated with respect to trees treated with urea used as the control. The organic fertilizer was applied entirely at the beginning of the experiment. Urea and biostimulants were applied weekly through fertigation and the latter also through foliar treatments in potted trees and on the soil, and through fertigation in field grown trees. The organic fertilizer resulted more effective than urea in promoting the growth of young olive trees. The addition of biostimulants, through fertigation and foliar treatments, to trees treated with the organic fertilizer caused further growth of the trees in the latter part of the season. The effects of the organic fertilizer and biostimulants on the photosynthetic activity were also evaluated.

Keywords: *biostimulants, Olea europaea L., organic fertilizer, photosynthesis, plant nutrition.*

BIOACTIVITY OF SILYLATED LIGNOCELLULOSIC BIOMASS OF SEA BUCKTHORN

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Abstract

Currently, the search for ecologically friendly products that promote plant productivity, quality, and resistance to biological and abiotic diseases without harming the environment is a very actual task. More care is needed to grow organic products, but the investment pays off with healthier and better-quality produce. The high potential of lignin-containing biomass for application in agriculture as fertilizers has been well documented and further improvements of lignin-based products efficiency by modification are under development. In this study, the residue of sea buckthorn biomass after the isolation of biologically active substances was used as a lignin-containing raw material for the preparation of the organo-mineral fertilizer. The organo-mineral complex (SBT-Si) was obtained by modifying SBT biomass with silicon (Si)-containing inorganic oligomer. The content of Si was 2 and 5 % on SBT biomass dry matter. The aim of this study was to evaluate the SBT-Si complex as an activator for the growth and development of plants. It was shown that SBT-Si at a rate of 2 g/L soil has a favourable influence on plant development, with the best results for SBT-Si with a content of silica 5% on SBT biomass dry matter. Significant development of the plant root system is confirmed by its increased volume (36-76%) and the volume of earth clod that plant roots are able to keep. The results confirmed that SBT biomass after extraction is a prospective basis for the development of organo-mineral fertilizers.

Keywords: *lignocellulosic biomass, silicon, organo-mineral complex, fertilizer, sea buckthorn*

ASSESSMENT OF NUTRITIONAL STATUS AND DIETARY INTAKE IN TYPE 1 DIABETIC CHILDREN AND ADOLESCENTS

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Abstract

Objective: The aim of this study was to evaluate the relationship between anthropometric characteristics, dietary intake and glycemic control (GC) in comparison with international guidelines. **Materials and methods:** The study included a sample of 240 children, aged 15 years old or less with T1D. A structured questionnaire was used to collect information on the socio-demographic status. Weight, height, and WC were measured and WHtR and BMI were calculated. Biochemical measurements were determined. Dietary intake was assessed using three 24-hour recalls. **Results:** Saturated fat intake was five times higher than recommended. Only 8.3% of participants reached the recommended level of fiber. Overweight and obesity was significantly higher in children with poor GC to those with good GC. In addition, participants with poor GC had significantly low intakes of calories, carbohydrates, fiber and high intakes of fat and SFAs. **Conclusion:** The results revealed that the dietary quality was poor and adherence to dietary recommendations was low with insufficient fiber intake and excess SFA. These results suggest that GC can be improved by a healthy, balanced diet by increasing fiber intake and limiting SFA intake.

Keywords: *type 1 diabetes; overweight/obesity; dietary intake; glycemic control.*

ASSESSMENT OF DIET QUALITY IN CHILDREN AND ADOLESCENTS WITH TYPE 1 DIABETES

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Abstract

The present study aimed to assess dietary diversity and variety and their relationship with micronutrient adequacy in children and adolescents with type 1 diabetes (T1D). A cross-sectional study was carried among 240 children and adolescents with T1D. Weight and height were measured and BMI was calculated. Dietary intake data were obtained from two 24-h recalls. A Dietary diversity (DDS) and dietary variety scores (DVS) and mean adequacy ratio (MAR) and nutritional adequacy ratios (NARs) were calculated and compared according to socio-demographic/anthropometric categories. 52.1% of the patients were female. The mean age of the patients was 8.49 ± 4.1 years. The mean BMI was 19.44 ± 5.24 kg/m²; the mean DDS was 4.62 ± 1.20 and the mean MAR was 0.66 ± 0.11 . Older children living in rural areas have a low DDS/DVS. Parental education and income level are associated with DDS/DVS. General and central obesity were significantly elevated in children with high DDS. In addition, a high intake of vegetables, eggs, fiber and micronutrients (Magnesium, Calcium, Potassium, Zinc, Phosphorus and Vit B1) is associated with a high DDS; however, high DVS is associated with high consumption of dairy products, carbohydrates and low intake of protein and fat. There are also positive correlations between DDS/DVS and NARs for various nutrients. The quality of the respondent's diets is moderately diversified. DDS or DVS can be used as indicators of micronutrient adequacy in Moroccan T1D children. Nutritional education needs to be strengthened to improve dietary diversity in children, especially in rural areas.

Keywords: *Diet quality, nutritional adequacy, child/adolescent, T1D.*

IMPACT OF NUTRITION EDUCATION ON METABOLIC CONTROL AND DIETARY INTAKE IN CHILDREN WITH TYPE 1 DIABETES

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Abstract

The objective is to evaluate the impact of two methods of NE on anthropometric parameters, GC, lipid profile and dietary intake. The study including a sample of 110 children and adolescents, aged 15 years or younger with T1D. A structured questionnaire was used to collect information on sociodemographic status. Weight, height, and waist circumference were measured and Waist-to-Height ratio (WHtR) and body mass index (BMI) were calculated. HbA_{1c} was determined. Food intake was assessed using two 24-hour recalls. Participants were divided into two groups: a collective group (CG=54) that received a collective NE and another group that received an individual NE (IG=56). A significant reduction of the studied parameters was observed after 3 and 6 months in the 2 groups. However, the intergroup difference was significant for WHtR and HbA_{1c} only. After 6 months, a significant increase in calorie, carbohydrate, and MUFA intakes and a significant reduction in lipids, SFA, PUFA, and fiber intakes were observed in both groups. Individual NE has proven to be the most effective method in improving HbA_{1c} and dietary intake in poor GC T1D patients.

Keywords: *nutrition education; type 1 diabetes; children/adolescents; glycemic control; dietary intake.*

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* root 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 a 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 the absence of light in the 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 Laser Scanning Microscopy*, *Nitrogen Fixation*, *Auxin*, *Vigna radiata*.

ASSESSMENT OF SOIL QUALITY PARAMETERS AFTER 4 YEARS OF COMPOST APPLICATION IN ORGANIC FARM

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Abstract

The soil organic matter, pH value, and amount of plant nutrients are significant soil quality parameters. Three soil plots (four reps), from 1.2 to 3.0 ha, were amended yearly for 4 years, respectively, with 5, 10 and 20 Mg ha⁻¹ yr⁻¹ of mature compost obtained from cattle manure and post-harvest residues collected from organic (biodynamic) farm. The 2000-hectare farm in Juchowo (northern Poland) is focused exclusively on cattle feed production (700 heads of cattle) and grassland grazing. The biodynamic farm promotes practices with plant biodiversity in the field, conservative tillage system, and crop plant rotation with Fabaceae family. Organic farming management relies on the purposeful maintenance and replenishment of soil fertility. The amended soils, and a control soil plot after 4 years (2017-2021) for the content of total organic carbon (TOC), total organic nitrogen (TON), dissolved organic carbon (DOC), dissolved organic nitrogen (DON), total exchangeable base cations (TEB) values, pH, and enzymatic activity were analyzed. The experimental data of this work indicate that the compost application may significantly affect the soil quality, fertility, and that the approach used in this work allows one to trace the fate of organic matter in the soil of organic farm. Conservation tillage, crop rotation, and compost application resulted in a statistically insignificant increase in average organic carbon content. The most efficient dose of compost to enhance the pH appeared to be 5 Mg ha⁻¹ yr⁻¹. Application of compost resulted in an increase of TEB, but not statistically significant. Soil samples from all analyzed plots in 2021 exhibited significantly lower average DOC content. After 4 years compost application, a significant increase in enzymatic activity of dehydrogenases, catalase, and alkaline phosphatase has been achieved.

Key words: *organic farming, compost, soil organic matter, enzymatic activity*

PRODUCTION OF FERTILIZERS FROM BIOWASTES FOR ORGANIC AGRICULTURE

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Abstract

Biowastes (garden and park wastes, food and kitchen wastes from households and restaurants) are a group of municipal wastes, which mass has recently increased significantly. Currently due to the rapid increase in the mass of municipal solid waste, it must be perceived as a multidimensional global problem. Thus proper waste management must be developed to attain such goals as prevention of waste generation and reduction of its volume, as well as encouraging its reuse and raw material recovery. Biowaste composting is a popular and cheap solution, in line with the circular economy concept and principles of sustainable management of organic mass. Such composts can be important organic fertilizers for use in organic agriculture. However, the quality of composts must be valorized and verified, the more so as they are made of waste of different origins. In this study, the quality of composts and vermicompost prepared from various biowastes was assessed in terms of their use for organic agriculture. In the analyzed materials the content of macro- and micronutrients essential for plants, heavy metal amounts as well as the quantity and quality of humic compounds were determined. On the basis of the obtained results it can be concluded that both vermicompost and composts showed good quality, serving as a valuable source of organic matter and nutrients for plants and thus they can be used for organic agriculture. Moreover, the content of heavy metals in these organic materials did not exceed the permissible standards.

Keywords: *organic wastes, vermicompost, compost, macro- micronutrients, humic compounds*

NITROGEN METABOLISM OF SELECTED VEGETABLES FROM ORGANIC AND CONVENTIONAL CROPS

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Abstract

Excessive accumulation of nitrates in vegetables has been the subject of intensive research for many years. The amount of nitrogen in plants is mainly influenced by the cultivation method and environmental factors. Moreover, the content of nitrates is genetically controlled and may constitute a characteristic feature of a species or even a variety. There has been a growing interest in organic food among Polish consumers for a long time. Compared to generally available fare on the market, organic food is characterised by a higher nutritional value and lower levels of nitrates, pesticide residues, growth regulators, antibiotics or synthetic food additives. In Poland, organic food stores are mainly located in large urban centres, where, unfortunately, foreign products still dominate. The study aimed to determine the level of selected indicators of nitrogen metabolism of vegetables from organic (organic food store) and conventional (market and supermarket) crops. Nitrates, chloroplast pigments and the activity of enzymes of the nitrate biosynthesis pathway - nitrate reductase (NR) and glutamine synthetase (GS) were determined in the aerial parts of selected plants of the amaryllis, brassica, quinoa and celery families. Unfortunately, in most cases, no significant differences in the level of nitrates between organic and conventional farming were observed. Moreover, the permissible nitrate content was significantly exceeded. The activity of NR was closely related to the level of nitrates, in contrast to the activity of GS.

Keywords: *Nitrates, Nitrate reductase, Glutamine synthetase, Chloroplast pigments, Vegetables*

SOIL FUNCTIONAL-ECOLOGICAL ASSESSMENT IN TRADITIONAL AND ORGANIC VINEYARDS ACCORDING TO SOIL RESPIRATION AND MICROBIAL BIOMASS

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Abstract

Compared to other agroecosystems, vineyards are more susceptible to environmental risks such as erosion, biodiversity loss, soil and plant pollution due to high pesticide load. Early detection and prevention of viticulture environmental impacts are of great relevance. This paper examines the ecological state of brown mountain gravelly loamy soils under vineyards cultivated using traditional and organic technologies in 15 farms of the Northern Black Sea region. Assessment of soils ecological functions and their microbiota ecophysiological state is based on various parameters of soil respiration and their correlation with soil agrochemical state. The indicators of substrate-induced respiration and the carbon content of microbial biomass were 3.4 times higher in the soil of organic farms than traditional ones, but their microbial metabolic coefficients, on the contrary, were 1.5 times lower indicating a more stable state of the soil-biotic system in organic farms. At the same time, the low coefficient of microbial respiration in the soils of organic farms compared to traditional ones (0.02 – 0.08 vs. 0.10 - 0.27) connected with their insufficient supply of mobile phosphorus and exchangeable potassium. So, analyzing the ecophysiological state of the soil microbiota is important not only for assessing the current state of ampelocenosis soils, but also for making timely and informed decisions on making changes to vineyard management elements in order to support the ecosystem services of the soil and obtain high-quality wine products that is very valuable for agroecological DSS.

Keywords: *Vineyard, Organic farming, Soil quality, Soil respiration, Environmentally friendly agrotechnologies.*

CHITOSAN AND OTHER ANTITRANSPIRANTS – THEIR INFLUENCE ON DIFFERENT ASPECTS OF ORGANIC AND USUAL PLANT PRODUCTION

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Abstract

The work presents main findings from investigations of our and other different researcher carried out on different cultivars using chitosan, its derivatives, nanoparticles and other antritranspirant compounds (like Di-1-p-menthene). The work demonstrates that this chitosan (and other antitranspirants) is highly effective against the most dangerous diseases and pathogens in different cultures. Also, natural origin of chitosan (and also, other antitranspirants) makes it suitable for use in organic agriculture. Furthermore, it also contributes to improving yield and different plant physiological and growth parameters. Additionally, it induces excellent resistance to some abiotic stresses (drought, salt, and low temperature) and reduces their negative impact on different cultivars.

Keywords: *chitosan, antritranspirants, phytopathology, organic agriculture, yield and growth of a crops*

THE INFLUENCE OF SOME BIO-PRODUCTS ON GERMINATION AND PROTECTION OF BASIL SEEDS

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Abstract

Basil (*Ocimum basilicum* L.) is an annual herb with medicinal, edible and economical values. To reach a yield potential, among other things, seed high germination percentage and seed vigor are required. The aim of the study was to discover the most efficient biopreparations with a beneficial effect on basil seed vigor, germination and seed health. Testing was conducted with two plant protection products, permitted in organic production ('Exstrasol F', 'Polyversum'), and three herbal preparations (fermented valerian extract, fermented extract of yarrow, and fermented LAB mix). Seed germination testing followed the standard procedure suggested by the Rule book on seed quality control, while 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 three replications, and the seeds were observed on the 4th and 14th day following the treatment. The seed germination was increased in all treatments, in comparison to control. The treatments with fermented extract of yarrow had the highest effect on seed vigor. Based on the symptoms, the presence of *Alternaria* sp. was confirmed on the seed surface. Compared to control, the infection of seeds was reduced in all treatments, but the fermented extract of yarrow had the highest effect on disease reduction.

Keywords: *Ocimum basilicum* L., bio-products, fermented extracts, germination, seed health, *Alternaria* sp.

EFFECTS OF ORGANIC FERTILIZERS APPLICATION ON FRUIT QUALITY IN MELONS

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Abstract

The need for consumption of vegetable fruits obtained from organic production has increased significantly in the last ten years. Melons (melons and watermelons) play a significant role in human nutrition. Compared to conventional melon production, the biggest problem in organic production is lower yield. This can be overcome by creating melon and watermelon varieties that are more suitable for growing in the organic production system. In this two-year field experiment, 5 melon, and 5 watermelon genotypes were used. The trial was conducted in an open field in the Smederevska Palanka. The effect of the application of four different commercial organic fertilizers on five characteristics of melons was observed. Mineral fertilizer was included in the trial as a control. The aim of the study was to determine the best melon and watermelon genotypes for the organic system of production. The greatest positive effects of the application of organic fertilizers were determined in the watermelon genotype Fairfax. Compared to the control, the fruit weight was increased by 15%, the sugar content up to 5%, while the thickness of the rind was decreased by 11%. In melon has been observed a smaller effect of the application of organic fertilizers, especially for the observed traits: weight of fruit and total sugar content. For Passport (melon genotype) was recorded 22% higher weight of fruits harvested from plants treated with organic fertilizers than in the control. The results showed that the Charentais, Passport (melon), Fairfax, and Greybelle (watermelon) are the genotypes that could be recommended for organic production systems.

Keywords: *Cucumis melo L.*, *Citrullus lanatus (Thunb.) Matsum. et. Nakai*), sustainable agriculture, conventional production.

PRODUCTIVITY OF ORGANIC WINTER WHEAT IN A LONG-TERM EXPERIMENT

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Abstract

The objectives of the present study were to evaluate the effects of organic (ORG) and integrated (INT) cropping systems, and different pre-crops on grain yield of winter wheat. The long-term field experiments have been conducted since 1999 on haplic luvisol developed on pluvial sediments mixed with loess. The climate of experimental area is continental, with average long-term temperature 9.9°C, long-term annual rainfall 547.6 mm. The results after 21 years of field experiments were evaluated. The share of N-fixing crops (both, perennial and annual) in the 6-course crop rotations was 50% in organic system and 33% in integrated one. Grain yield of winter wheat did not differ significantly between the two systems after perennial pre-crop alfalfa (5.51 t.ha⁻¹ in INT, 5.16 t.ha⁻¹ in ORG). However, after annual pre-crops (common peas, spring barley) in INT system, the grain yields of winter wheat were significantly higher (5.91 and 5.79 t.ha⁻¹) compared to organic system (5.1 t.ha⁻¹), in which perennial alfalfa was a pre-crop for winter wheat. This result can be attributed to higher water extraction from the soil by alfalfa, compared to annual pre-crops under rain-fed conditions of experimental area. Analysis of yield components revealed, that in INT system, higher yields were attributed to higher number of kernels per m² and higher thousand kernel weight after annual pre-crops.

Keywords: *organic and integrated system, yield of winter wheat, pre-crop effect*

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MICROBIAL COMMUNITY STRUCTURE IN PURSLANE *RHIZOSPHERE* AFFECTED BY DIFFERENT ORGANIC AND INORGANIC FERTILIZER RATES

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Abstract

Portulaca oleracea (purslane) is a wild edible plant of the Mediterranean area that represents an extraordinary food source and a basic ingredient in the so called “Mediterranean diet”. However, little is known about the effects of applying inorganic fertilization versus organic on the plant and on the rhizosphere microbiota within a sustainable use of agricultural resources. Different doses of inorganic fertilization (N-P-K) were applied: a) 300-100-100 (IT1); b) 300-200-100 (IT2); c) 300-200-200 (IT3); d) 600-100-100 (IT4) compared to e) compost extract (equivalent to 300-x-x (OT)). The soil microbial community was analyzed using Illumina MiSeq sequencing. Our results revealed differences in the composition and structure of the rhizosphere bacterial and fungal communities between fertilized and non-fertilized purslane plants according to Non-metric multidimensional scaling (NMDS) analysis. In the case of bacterial communities, only the inorganic fertilization treatments influenced the community composition. The Shannon index significantly decreased under the highest N doses treatment (IT4), showing the OT treatment the highest richness of bacteria and the higher number of indicator families. With respect to the fungal communities, there were three clearly-different fungal communities (C together with IT3, IT1 together with IT2 and IT4, and OT), the values of the richness and Shannon index being significantly lower under the IT1, IT2 and IT4 treatments. This study demonstrates that the responses of growth of purslane plants to fertilization as well as those of the composition and diversity of soil microbial communities are dependent on the fertilizer doses applied and the source of nutrients origin (inorganic or organic).

Keywords: *purslane, inorganic fertilizers, microbial community, compost tea.*

Acknowledgments: This work was funded by the Spanish Ministerio de Ciencia e Innovación (project PCI2020-112091), General Secretariat for Research and Technology of Greece (Prima 2019-11) and PRIMA foundation under the project VALUEFARM (PRIMA/0009/2019)

CONNECTIONS BETWEEN PLANT FEEDING, N, P, K AND QUALITY IN FRUIT GROWING

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Abstract

Scientists research for food requirements of fast growing world population and looking of alternative food resources. Problems of food resources are still at the top of the world agenda. The other problem of the food resources is improvement of quality in fast growing agricultural production. Manure usage increases yield but also increase or decrease quality of products. Excessive or insufficient usage of manure lowers yield but also lowers quality, durable and taste of fruit. Excessive usage of manure cause some compounds which are harmful for human health.

Keywords: Plant feediingg, quality, fruit growing.

**THE EFFECT OF DIFFERENT PACKAGING APPLICATIONS ON THE
DEVELOPMENT OF *EPHESTIA CAUTELLA* IN DRIED ORGANIC WHITE
MULBERRY (*MORUS ALBA*)**

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Abstract

It is aimed to prevent the moth problem in the product, which is caused by the development of the *Ephestia cautella* (*E. cautella*) moth pest, which occurs especially in summer and at high storage temperatures, due to the absence of pesticide use in the organic dried mulberry product, with different packaging applications. In the production process of the organic dried mulberry product, due to the high amount of sugar due to the composition of the fruit and the risk of dissolving the sugar with water and melting the fruit, unlike other dried fruits, the washing process is not applied. In the drying process, due to the risk of darkening of the fruit, air drying is applied and the product is subjected to gas fumigation such as carbon dioxide or nitrogen in bulk in the warehouses where high oxygen gas is eliminated. However, gas fumigation process has disadvantages such as long application time, insufficient effect in every part of the product because the product is in bulk. In addition, the product may be contaminated with moths after it has been fumigated. As a result of this, the product encounters a moth problem, especially in summer, at high temperatures, and this situation causes a serious economic loss to the companies that trade this product, both in exports and in the domestic market. Therefore, in this study, the effect of different packaging applications on the moth problem of organic dried mulberry will be investigated. For this purpose, active packaging applications using modified atmosphere packaging and/or oxygen trapping bags will be used. In order to determine the effect of temperature on the moth problem, storage will be made at 25 °C and 38 °C. In the study, antioxidant capacity, total phenolic and total flavonoid substance amounts will also be analyzed during storage. In the literature, there is no study examining the effect of packaging in modified atmosphere, despite the moth problem in dried fruits. In this context, the study has a unique value in terms of both being commercially applicable and filling the gap in the literature.

Keywords: applications, white mulberry.

THE EFFECT OF DEHYDRATION PROCESSES ON TOTAL PHENOL, ANTIOXIDANT ACTIVITY, FATTY ACID COMPOSITIONS AND POLYPHENOLICS OF WHITE MULBERRY FRUITS

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Abstract

In this study, the effect of dehydration process on oil contents, total phenol, total flavonoid contents, total carotenoids and antioxidant activity values, phenolic compounds and fatty acid compositions of mulberry fruits dehydrated by microwave and oven systems was investigated. While moisture contents of mulberry fruits are reduced from 83.90% (control) and 18.55% (oven), the oil contents of mulberry fruits treated were measured between 6.75% (oven) and 7.40% (control). In addition, while total phenolic amounts of mulberry fruits dried by microwave and oven systems increase from 177.97 mg GAE/100g (control) to 416.88 mgGAE/100g (microwave), antioxidant activity values of dehydrated mulberry fruits also increased from 55.14% (control) and 89.43% (microwave). Also, carotenoid contents of mulberry fruit samples ranged from 0.21 µg/g (control) to 0.45 µg/g (microwave) while total flavonoid contents of mulberry fruits dried by microwave and oven systems are determined between 180.50 (control) and 1082.17 mg/100g (microwave). The highest carotenoid, phenolic content, flavonoid contents and antioxidant activities were determined in mulberry fruits dehydrated by microwave oven. Phenolic constituents found at the highest levels in mulberry fruits dehydrated by microwave and oven systems were gallic acid, 3,4-dihydroxybenzoic acid, (+)-catechin, 1,2-dihydroxybenzene and syringic acid. In general, the amount of phenolic constituents of mulberry fruits dehydrated by microwave was identified higher than those in mulberry fruits dehydrated by oven drying system. Linoleic acid contents of oils of dehydrated mulberry fruits varied between 75.05% (control) and 76.66% (microwave) while oleic acid contents of mulberry fruit oils were determined between 9.37% (microwave) and 9.87% (oven). Results showed significant differences depending on dehydration systems compared to control group.

Key words: *Mulberry fruit, oil, bioactive compounds, phenolics, fatty acids*

ENVIRONMENT PROTECTION AND NATURAL RESOURCES MANAGEMENT

CHEMICAL COMPOSITION AND NUTRITIVE VALUE OF THE MAIN PERENNIAL STEPPE PLANTS

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Abstract

The understanding of animal-plant relationships is a major element in the development and management of steppe rangelands, in order to implement rational methods of utilization of available resources, such as the setting of defenses. The purpose of this study is to estimate the nutritional value (energy value and nitrogen value) by the chemical composition of the main steppe plants grazed by animals and their digestibility. Thirteen plants are studied. The results of the chemical composition show high contents of organic matter and low contents of total nitrogenous matter. The evaluation of the energetic value shows that the best values of milk fodder unit (UFL) and meat fodder unit (UFV) are recorded for two species: *Atriplex canescens*, *Thymelaea virgata* (0.80 and 0.70). On the other hand, the lowest are those recorded for three species *Lygeum Spartum*, *Helianthemum lippii*, *stipa tenacissima* (0.40 and 0.30). Similarly, the evaluation of the nitrogen value shows that the best values of digestible nitrogenous matter (DNM) are recorded in *Marrubium deserti* (124 g/kg of DM) and *Thymelaea virgata* (104 g/kg of DM). On the other hand, the lowest are those recorded for *Stipa tenacissima* (26 g/kg DM) and *Thymelaea hirsuta* (32 g/kg DM). Finally, the estimation of the digestibility of all the perennial steppe species shows that the best values are recorded for two species *Atriplex canescens*, *Thymelaea virgata* (64 g/kg DM). On the other hand, the weakest are those recorded for *Lygeum Spartum*, *Helianthemum lippii* (41 g/kg of DM).

Keywords: *Chemical composition, Nutritional Value, Digestibility, Steppe.*

MANAGEMENT OF SUSTAINABLE WATER RESOURCES IN ALGERIA

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Abstract

Water supply in Algeria is distinguished by land geophysical limitations and factual management challenges. Algeria is divided into five hydrographic basins covering nineteen watersheds. The country abounds in extensive freshwater lakes and marshes in the northern part while numerous salty lakes dominate in the southern part. Regardless of the northern coastal area which occupies 16% of the total country area criss-crossed by dense network of short rivers, dry climate conditions exacerbated by water pollution from urban and industrial activities have largely impacted on water potential resources furthermore the country's overall socio-economic activities. In the last two decades, Algeria has deployed important investments to improve sustainably both monitoring and management of its substantial water resources through a supplemental reforms package which have included new dams construction, long-distance water transfer systems, new brackish water demineralization and waste water treatment plants and near lately, sea water desalination. Virtue of an appreciable increase in the available water resources, these measures have increased substantially water supply at low price to all consuming sectors despite a rapidly increasing population. In fact, even still limited, annual renewable water resources are estimated on average to be 11,670 million m³ which corresponds to about 292m³/capita/year, while the exploitable resources are estimated at only 7,900 million m³ per year. Efficient management and exploitation of these water resources would contribute actually to the development of the country socio-economic sectors.

Key words: *Water resources, Water withdrawals, Socio-economic impact, Algeria.*

WATER QUALITY IN TWO WETLANDS IN WESTERN ALGERIA (DAYAT MORSLI AND TELAMINE)

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Abstract

Diatoms are good indicators of the level of eutrophication of watercourses and the increase in the concentration of dissolved minerals. They are also affected by metals and pesticides. The objective of the present study is the evaluation of the pollution of two Lakes (Dayat Morsli and Télamine) of western Algeria through the calculation of the Generic Diatomic Index (GDI). The results allow the identification of two orders, Central and Penal. The latter one is the most represented with 11 families (*Bacillariaceae*, *Naviculaceae*, *Stephanodiaceae*, *Fragilariaceae*, *Eunotiaceae*, *Achnantheaceae*, *Cymbellaceae*, *Catenulaceae*, *Brachysiraceae*, *Surirellaceae*, *Cocconeidaceae*) and 13 Genera (*Nitzschia*, *Navicula*, *Cyclotella*, *Denticula*, *Eunotia*, *Achnanthes*, *Diatoma*, *Cymbella*, *Amphora*, *Melosira*, *Surirella*, *Fragilaria*, *Cocconeis*) at Lake Dayat Morsli and six families (*Fragilariaceae*, *Achnantheaceae*, *Eunotiaceae*, *Surirellaceae*, *Bacillariaceae*, *Naviculaceae*) and 13 genera (*Diatoma*, *Fragilaria*, *Eunotia*, *Cocconies*, *Achnanthes*, *Naviculaceae*, *Pinnularia*, *Cymbella*, *Amphora*, *Gomphonema*, *Nitzschia*, *Surirella*, *Cyclotella*) at Lake Telamine. The order of the centrals presents only one genus *Cyclotella* for the two sites studied. The generic study shows richness in number of genera *Nitzschia* and *Navicula* at Lake Dayat Morsli and reveals richness in number of genera *Amphora*, *Navicula* and *Nitzschia* of Lake Telamine. The values of the Generic Diatomic Index obtained show that the water of Lake Dayat Morsly is of poor biological quality.

Keywords: *Lake Dayat Morsli, Diatoms, Generic Diatomic Index, Lake Telamine*

SMALL-SCALE FISHERS' WILLINGNESS TO ADOPT PROPERTY RIGHTS COMANAGEMENT IN SOUTHERN BENIN: DISCRETE CHOICE EXPERIMENT APPROACH

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Abstract

The estuarian and lagoon environments of southern Benin are an atypical lake territory where stilt dwellings are found and which populations living exclusively from fishing have appropriated and exploited for generations. As this exploitation is at odds with the public rules set up by the State, problems of sustainability of water resources arise. This study aims to assess the factors that influence the willingness of small-scale fishers to adopt comanagement options for fishing property rights in southern Benin. A random sample of 276 small-scale fishers was interviewed. The data collected was analyzed using the Discrete Choice Experiment with latent class logit and mixed logit. The results show that 80% of the small-scale fishers are satisfied with the current management of property rights. However, they believe that this management is not sustainable because it does not consider population growth projections, socio-community infrastructure needs and space limitations on the water body. In addition, access to subsidies from the national agricultural development fund and support for technical and professional training outside of fishing make small-scale fishers agree to co-manage property rights for fishing. Measures to support income diversification and capacity building of small-scale fishers must be set up to reduce their fishing time and ensure the sustainability of resources.

Keywords: *Small-scale fishers, comanagement, subsidy, Benin*

ECOLOGICAL AND FOOD IMPORTANCE OF *VITEX DONIANA* SWEET (VERBENACEAE) IN SOUTHERN BENIN

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Abstract

Non-timber forest products play important ecological, economic, nutritional and medicinal roles. This study aims to determine the ecological and food importance of *Vitex doniana* in Southern Benin. Data on the presence, threats to the ecology, food transformations and others uses of *V. doniana* were collected in the agro-climatic zones of Guinea-Congolese located between 6° 25' N and 7° 30' N, Sudano-Guinean located between 7° 30' and 9° 45' N and Sudanese located between 9° 45' N and 12° 30' N. All data were analyzed using the software R v 4.0.2. The results show that the species is used for food and/or commercial need in the local markets. The leaves and fruits of *V. doniana* are sold in the southern region of Benin as a more commercialized species in the markets. But, these uses affect the distribution of the species and reduce considerably its fruit production (35-40%). However, 30-70% of the population of *V. doniana* is threatened by husking and pruning. As the species has multiple uses and its ecology is compromised by poor management, it is therefore essential to restore its habitat and also make its plantations in order to limit the threats weighing on the species in natural habitat.

Keywords: *Ecology, Fruit, Threats, Uses.*

OVERVIEW AND USE VALUE OF VINEYARD WEEDS IN BOSNIA AND HERZEGOVINA

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Abstract

Weeds are an extremely complex, dynamic and very diverse category of plants, whose main feature is under greater or smaller anthropogenic influence. Floristic-phytocenological research of weed flora and vineyard vegetation was conducted during three vegetation seasons (2019, 2020, 2021), from spring to mid-autumn. The aim of the research was to determine the current state of weed flora in vineyards in Bosnia and Herzegovina and to analyze the flora with regard to affiliation to life forms, floral elements, use value. The research included 73 vineyard sites in Bosnia and Herzegovina. During three years of research into the weed flora of Bosnian vineyards, 155 species of vascular flora were recorded, classified into 50 families. Negative properties are most often attributed to weeds, and interestingly, they have a very wide use value. A large number of weed species are used as medicinal, honey-bearing, edible, spicy and fodder plants. They have other interesting and useful use values (decorative, compost, biofertilizer, insecticides, plant stimulants, erosion protection, application in the cosmetics and food industry, etc.). Out of 155 recorded weed species in the vineyards of Bosnia and Herzegovina, the most common use of weeds is for medical (medicinal) purposes (120 weed species or 28%), followed by food (102 weed species - 24%), as honey plants (85 species - 20%), and fodder (38 species - 9%). They are least used as spices (18 species - 4%) while as many as 60 species (14%) have poisonous properties. 117 weed species have a different use value, than applications in various types of industry, such as ornamental species, use for compost, biofertilizer, biocides, plant stimulants, erosion protection and use in cosmetics.

Keywords: *weeds, vineyards, use value*

WETNESS OF KARST FIELDS AT EAST HERZEGOVINA REGION (BOSNIA AND HERZEGOVINA)

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Abstract

The article refers to the occurrence of soil moisture in the karst fields of East Herzegovina region, in the south of Republic of Srpska (RS), political entity within Bosnia and Herzegovina (B&H). The Copernicus Water and Wetness (WaW) database has been used, based on the photointerpretation of Sentinel satellite images, in resolutions 10 m and 20 m. Wet zones are divided into four categories, based on the percentage of water and moisture over the year: permanent water, intermittent water, permanent wet areas and temporary wet areas. Compared to other regions of RS, East Herzegovina has the largest area of temporary wetlands in the amount of 3.7% of the territory. The karst fields contribute the most to this, as they cannot receive all the water in the underground channels during the rainy period of the year, so water spills on the surface. However, there are significant differences depending on the altitude of the karst field. Fields at higher altitudes have a high percentage of soil moisture while lower fields are relatively dry. This is largely due to human activities and agricultural production in densely populated areas around lower fields. Also, a correlation was observed regarding matching of humidity and grasslands. The high and medium altitude karst fields are the areas richest in grassland in RS. The aim of the research is to determine types of humidity in the karst fields of East Herzegovina region, as well as to define the zones where soil moisture is most present.

Keywords: *wetness, karst fields, East Herzegovina, WaW database*

RIVER NETWORK DENSITY BY LARGE NATURAL REGIONS IN BOSNIA AND HERZEGOVINA

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Abstract

The paper analyze EU-Hydro database on river network density within the Bosnia and Herzegovina (B&H). EU-Hydro is a dataset for all European Environment Agency 39 countries (EEA39), including B&H, providing a photo-interpreted river network, consistent of surface interpretation of water bodies (lakes and wide rivers), and a drainage model (also called Drainage Network), derived from EU DEM, with catchments and drainage lines and nodes. It is based on remote sensing imagery from the years 2006, 2009, and 2012. The density of the river network depends on several abiotic factors: climate, relief, soil type, geological layers, vegetation, etc. These factors differ in B&H according to the large natural regions that have a significant impact: the Pannonian Plain in the north, the Dinaric Mountains in the central part and the Mediterranean zone in the south. Research results show that the average density of the river network in B&H is 0.438 km/km². However, according to biogeographical zones that mostly matching with large natural areas, the density of the river network differs: it is densest in the Continental region with 0.477 km/km² followed by the largest central region with 0.433 km/km², and the rarest in the Mediterranean region with 0.372 km/km². The aim of this paper is to figure out which abiotic factors by natural regions crucially affect the density of the river network in B&H. In addition, it will be analyzed which regions have the highest risk of floods and whether the density of the river network affects that.

Keywords: *river, network, density, B&H, EU-Hydro.*

MONITORING OF SENSORY DYNAMICS OF *AMBROSIA ARTEMISIIFOLIA L.* POLLEN AS AN AEROPOLUTANT IN THE UNA-SANA CANTON DURING 2012-2021

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Abstract

Ambrosia artemisiifolia L. is known as an invasive roof. In addition to the fact that this plant suppresses the indigenous plant species, the pollen of this invasive plant spreads very quickly in the environment. It is both a weed and an allergen, but also a medicinal plant. It came to Europe and our region from America as bird food (pheasant). Nowadays, ragweed pollen grains in particular are of great interest to scientists and researchers in terms of its spread in the environment, but also the impact of high concentrations of pollen on human health. This plant is considered one of the harmful allergens for humans and is therefore present as a health problem. Due to its easy adaptation in the environment and suppression of indigenous plant species, ragweed is also an environmental problem. Monitoring of ragweed pollen is a very important segment of general environmental monitoring. High concentrations of pollen grains of this plant are especially present in the summer months until autumn. Especially very high concentrations are expressed in the period of pollen maturation. Since 2008, the concentration of ragweed pollen has been regularly monitored in the Una-Sana Canton. Equipment used research included a Hirst type pollen trap (sampler) Burkad, placed in Bihac. In general, the aim of this paper was based on the sensory representation of the dynamics of ragweed pollen for many years. In this research, the period of monitoring the dynamics of ragweed pollen was from 2012 to 2021. Research has shown that the highest annual concentrations of ragweed pollen was present from the second half of July, in August and the first half of September. In the observed period, the prevalence of ragweed pollen was about 50% compared to grasses about 15%, trees about 25% and other weeds about 10%.

Keywords: *Ambrose, Monitoring, Health problem, Ecological problem, Agricultural problem*

MELISOPALINOLOGICAL ANALYSIS OF HONEY SAMPLES FROM BOSNIA AND HERZEGOVINA

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Abstract

Melisopalinological research of honey samples from different localities from the territory of Bosnia and Herzegovina identified 21 species of pollen grains. Honey samples, five of them, can be divided into three groups: rapeseed honey, acacia honey and chestnut honey. Three families dominate, while the rest are present in a smaller percentage. Dominant pollen belongs to the families *Brassicaceae* with the highest representation, *Fagaceae* with a lower percentage and the family *Fabaceae*. In samples number 1 and 2, rapeseed pollen (*Brassica napus* L.) predominates and in the first sample it is 68%, and in the second sample rapeseed pollen accounts for 78%. Sample number 3 from Derventa has the highest representation of acacia pollen grains (*Robinia pseudoacacia* L.) with 44%. Samples numbers 4 and 5 according to pollen analysis show the dominance of chestnut pollen grains (*Castanea sativa* Mill.) in values of 86% for sample number 4 and 90% for sample number 5. Plant species of rapeseed (*Brassica napus* L.), acacia (*Robinia pseudoacacia* L.) and chestnut (*Castanea sativa* Mill.) proved to be the most important, despite a very short flowering period of only one month.

Keywords: Honey, Melisopalinological analysis, Bosnia and Herzegovina

EFFECT OF PHYSICAL SOIL PROPERTIES ON POTATO YIELD IN DIFFERENT AGRO-ECOLOGICAL CONDITIONS

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Abstract

The soil is the basic substrate, which with its physical, chemical and biological properties greatly affects the productivity of cultivated plants. Researches in the open field were carried out in two-year period at three locations (East Sarajevo, Rogatica, Bijeljina) that differ from each other in terms of climate and soil conditions. The factors included in the field research are locality (A) and year (B). The tested soil types differed in physical properties and, in combination with climate factors, had a significant effect on the yield of potatoes. The yield of potatoes in the open field was significantly influenced by locality and year. Potatoes grown in Bijeljina had the highest yield but the lowest was in East Sarajevo. The most favorable physical properties of the soil at the location of Bijeljina affected the yield of potatoes, so the highest yield was achieved at this location.

Key words: *potato, soil, location, physical properties, agro-ecological conditions*

EFFECT OF SOIL PROTECTION TILLAGE ON SOME MICROBIAL PARAMETERS OF MODERATELY ERODED CALCAREOUS CHERNOZEM

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Abstract

Water erosion is the most widespread soil degradation process in Bulgaria. As a result of its action, the surface soil layer is disturbed, nutrients and organic matter are lost and the soil structure deteriorates. To counteract these negative processes, it is necessary to apply soil protection tillage. The assessment of the efficiency of soil protection tillage can be done not only on the basis of soil physical and chemical parameters, but also on the parameters of soil microbiological activity. Enzyme activity and microbial biomass carbon contents are sensitive indicators for changes in soil conditions and are widely used as parameters characterizing soil quality. The aim of the present study is to establish the effect of soil protection tillage (tillage across the slope) in wheat growing on the amount of microbial biomass carbon and the activity of the enzymes alkaline phosphatase, protease and urease. The experiment was carried out in field conditions on moderately eroded Calcareous Chernozem. The microbial parameters were determined twice (in spring and autumn) at two soil depths (0-10 cm and 10-20 cm). It was established that the effect of the studied soil protection tillage was different for the individual parameters, soil depths and sampling seasons. A positive effect was obtained for microbial biomass carbon contents for both layers in spring, protease activity for the surface soil layer in both seasons of soil sampling and urease activity for the same layer in autumn.

Keywords: *Calcareous Chernozem, Erosion, Enzyme activity, Microbial biomass carbon contents.*

EXPERIMENTAL RECOVERY PROCESSES OF PRIORITY HABITAT 62C0 * "PONTO-SARMATIAN STEPPES IN THE KALIAKRA AREA" - PROJECT RESULTS

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Abstract

In the European Union, natural habitat 62C0* Ponto-Sarmatian steppes is limited in its range and occurs only in two member states - Bulgaria and Romania. This grassland habitat was a subject to various impacts over the years and suffers on a decrease in its area, changes in species composition and occurrence of invasive and ruderal species. The most significant threats to the habitat are related to intensive or excessive grazing of livestock, abandonment of grassland management (e.g. cessation of grazing or mowing), afforestation, plowing, conversion into agricultural land, conversion to other land uses (tourism, recreation, urbanization, construction of infrastructure), construction of energy plants and natural succession. Restoration is the tool used to respond to ecosystem destructive processes. Ecological restoration includes managing and supporting the self-restoration of a degraded, damaged or destroyed ecosystem, it is a means of maintaining and conserving biological diversity. The purpose of the restoration activities in the habitat 62C0 * Ponto-Sarmatian steppes is to improve the condition of damaged areas, restoration of individual components and restoration of specific structural elements of the habitat, as this goal corresponds to the objectives of the project "Restoration of priority natural habitat 62C0 * "Ponto-Sarmatian steppes in the region of Kaliakra".

Keywords: *ecological restoration, steppe habitats, damaged terrains, ecosystems, Ponto-Sarmatian steppes*

STEPPE VEGETATION IN THE REGION OF SOUTH DOBRUDJA, BULGARIA

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Abstract

During the period 1997-2000 (realizing BSBCP’s project “Dobrudja”) and 2012 – 2018 (realizing joint project with the Agricultural University), collecting missions for establishing the biodiversity in the region of the dry river- Suha Reka were carried out. It is a canyon with many preserved features of the stony steppe, rocky terraces, grasslands, forests and river pools. Through the expeditions, the plant species were described northwest from Dobrich, up to the border with Romania. They established 462 plant species to 69 genera and represent about 1/3 of the described 1508 species in South Dobrudja- 3 Balkan and 1 Bulgarian endemics, 19 rare and endangered species for the Bulgarian Flora and about 50 species important as a genetic resource. As a result of the study biotopes with typically steppe species (rare for lowlands ecosystems yet) were established. The habitats for *in situ* conservation were outlined. The collecting samples of over 80 – forage, medicinal and ornamental plants were included in *ex situ* collection in the Genbank of IPGR, Sadovo and *in situ* conservation.

Key words: vegetation, flora, steppe habitat, species, diversity, *ex situ*, *in situ*

RESPONSE OF SOIL CHEMICAL PROPERTIES TO BIOCHAR AND NITROGEN APPLICATION IN A FIELD EXPERIMENT

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Abstract

A two-year field experiment was carried out with maize (*Zea mays* L.) at two biochar (BC) doses of (5 and 10 t. ha⁻¹) and two nitrogen fertilizer rates (130 and 260 kg. ha⁻¹) in Tsalapitsa village (Plovdiv) on Alluvial-meadow soil (Fluvisol). The aim of the study was to find out the influence of biochar as an aftereffect, as well as nitrogen fertilization on soil physicochemical and agrochemical properties. In order to observe the effect of biochar in the second year, the variants from the first year (B₍₁₎5N130, B₍₁₎10N130, B₍₁₎5N260 and B₍₁₎10N260, without the controls K1N130 and K2N260 were left without the addition of biochar, and for the second year, new variants were set up according to the same scheme. During the vegetation of maize, the influence of biochar as the aftereffect was observed with increase in pH values (0.2 - 0.3 units) in comparison with the control variants (without biochar, nitrogen fertilization only), which was confirmed by its application in the second year. There were positive changes in the mineral N content of the studied treatments as the aftereffect, compared to the controls and the second-year treatments, which may be related to the ability of the biochar to fix nitrogen and protect it from leaching, especially on vulnerable soils such as the Fluvisol studied. A slight increase in organic carbon (0.09-0.32 %) was also found at the lower N rate (130 kg. ha⁻¹) in the aftereffect variants. In these variants, a slight increase in cation exchange capacity, exchangeable Ca and the degree of base saturation was also observed. Biochar utilization had little effect on the investigated properties of the Fluvisol. Applying the lower doses of biochar in longer term would have a more significant impact.

Keywords: *pH, cation exchange capacity, organic carbon, soil mineral nitrogen, second year.*

SOIL AND CLIMATIC CAPACITY OF THE SILISTRA REGION (BULGARIA) FOR AGRICULTURE

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Abstract

This article describes the soil-climatic resources in the Silistra region, North-Eastern Bulgaria. The research presents the main climatic factors on which the development and yield of crops depend and the balance of soil resources by main soil types and with a brief physicochemical characteristic of the soils. Soils in Bulgaria are mapped and classified by soil specialists in M 1:10,000. The existing methodology groups soil differences into agro-soil groups and subgroups. These data classify soil resources via Bulgarian classification and World reference base and they cover area and soil type. The manuscript presents statistical data of 723 soil-cartographic units, united into 5 agro-soil groups and 11 subgroups. The information used covers 92 soil-cartographic surveys (these are soil maps with one or more settlements) for the entire area. The data contains information about basic physicochemical indicators characterizing soil fertility: texture class, the content of soil organic matter of the surface horizon and sub-horizon, and soil acidity. The conclusion finds out that climatic conditions divide the Silistra region into two zones - with "hot" and "moderately hot" temperatures during the growing season and a deficit in the balance of atmospheric moisture (the main limiting factor in agriculture). The territory of the Silistra district is occupied by soils suitable for agriculture approximately 76% of the soil resources but mostly climatic conditions limit their effective agricultural use.

Keywords: *agrosoil group, agrosoil subgroup, climate, soils.*

ACCESSIBILITY OF AGRICULTURAL RESIDUES FOR BIOENERGY IN BURKINA FASO

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Abstract

Burkina Faso is a country located in the West African Sahelian zone. Agriculture employs more than 80% of the active population and generates large quantities of agricultural residues. Some of these residues, which are not valorized, could be used for energy purposes. This study aims to assess the bioenergy potential of these residues that could be gasified and to identify the potential number of gasification technologies. Three levels of potential for crop and agro-industrial residues are estimated for the year 2018. The calculation was based on product specific residue ratios depending on the type and yield of the crop. Sustainable recovery rates have been taken into account in order to protect soil fertility and human and animal consumption. The results show that the theoretical agricultural residue pool is about 8 million tons. Sustainable recovery rates have been considered to protect soil fertility, human and animal consumption. Only cotton stalks and rice husks are recoverable at 75% and 20%, respectively. The mobilizable potential for bioenergy is 723,260 tons of cotton stalks and 6,497 tons of rice husks. These residues have an energy potential of 44,638 toe and 253 toe, respectively. The agricultural residues can therefore contribute sustainably to satisfy the bioenergy needs of the country agro-industrial sector.

Keywords: *agricultural residues, bioenergy, Burkina Faso.*

IRRIGATION NETWORK DIAGNOSIS: CASE OF KARFIGUELA PADDY FIELD IN BURKINA FASO

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Abstract

In Burkina Faso (BF), irrigation systems suffer from numerous technical, organizational, land and structural problems, that strongly undermine their performance as the case of irrigated perimeter of Karfiguéla. This research has contributed to the reflection on the performance and operation of gravity irrigation networks on irrigated perimeters. An approach based on a: (i) mapping using remote sensing of hydraulic networks (ii) a detailed visual inspection of hydraulic infrastructure (iii) estimation of canals' hydraulic efficiency (iv) and surveys of the various actors involved in the management of the perimeter was used. These results show that Karfiguéla perimeter has an area of 360 ha and is supplied by a network made up of a supply canal, a primary canal, four (4) secondary canals, 37 tertiary ones, and quaternary ones for plots water supply, all in ordinary concrete except the quaternaries which are in rammed earth. The efficiency of the canals in rainy season, greater than 100%, shows that the irrigation network in rainy season functions as a drainage network it is disorderly and non-functional. The damage to the irrigation network, siltation, grassing, erosion, overturning, cracks are severe and persistent. The Strickler roughness coefficient is 68 for the feeder, 47 for the primary, between 32 and 52 for the secondaries and 31 for the tertiaries which also reflect a degradation of the channels. A complete rehabilitation of the hydraulic network, is essential to ensure the sustainability of the rice-growing activity, which has a concentration of nearly 1,200 farmers.

Keywords: *irrigation, hydraulic, water, remote sensing*

SOIL ELECTRICAL CONDUCTIVITY IN RELATION TO SOIL MICROCLIMATE AND SOIL RESPIRATION UNDER WHEAT AND BARLEY LAND COVERS

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Abstract

Soil electrical conductivity (EC) is an important indicator of soil health. It affects crop yields and suitability, many soil properties like plant nutrient availability, and activity of soil microorganisms which influence key soil processes including the emission of greenhouse gases such as carbon dioxide i.e. soil respiration. While it is well known that major drivers of soil EC are soil temperature and moisture content, less is known on the relation between soil EC and respiration. Therefore, the objectives of this research were to determine relation of soil EC and soil microclimate (soil temperature and moisture), as well relation of soil EC and soil respiration under three different land covers. A study on soil EC, microclimate and respiration under bare soil, winter wheat and winter barley was carried out from November 2020 until July 2021 on experimental field near Osijek city, continental Croatia. The results showed that EC is more related to soil microclimate elements i.e. soil temperature and soil moisture content than on soil respiration. Between 17% and 47% of EC can be explained by soil microclimate elements and none i.e. only 4% to 12% by soil respiration.

Key words: soil EC, soil CO_2 efflux, soil temperature, soil moisture content, Croatia.

TOXIC AND ALLERGENIC PLANT SPECIES IN KINDERGARTENS IN ZAGREB'S DISTRICT OF TREŠNJEVKA-NORTH

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Abstract

When designing open spaces for children, care must be taken to select plant species which are not dangerous to them. The aim of this study was to make an inventory of the dendrological flora of kindergartens in the Trešnjevka - North district and to determine the presence of toxic and allergenic plant species. The research was conducted in the period from May to July 2019 in a total of 13 kindergartens containing a playground. Kindergartens were divided into two groups according to kindergarten type, central and regional. In central kindergartens, a total of 26 poisonous species was identified with 199 recorded specimens (55%) and 35 allergenic species with 247 recorded specimens (68%). A total of 20 poisonous species with 79 recorded specimens (39%) and 29 allergenic species with 126 recorded specimens (62%) were identified in the regional kindergartens. The obtained results show that many poisonous and allergenic species are present on the premises of kindergartens and that their horticultural arrangement was not planned with the participation of experts.

Keywords: *toxic plant species, allergenic plant species, kindergarten playgrounds.*

CROP YIELD ON EROSION-PRONE SOILS FROM THE PERSPECTIVE OF REMOTE SENSING

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Abstract

There are currently many publications on the problems of erosion. Fewer publications focus on erosion processes and reduced crop yield, often calculated on the basis of reduced soil depth, loss of nutrients, and changes in soil physical properties. Although there are estimates of productivity loss at the European level, there is very little quantitative information on the impact of erosion on agricultural production at a regional and national level. We deal with the effects of soil erosion on crop yield in a highly-productive but erosion-prone chernozem agricultural area of the Czech Republic. The studied erosion and deposition areas show significant differences in soil properties, also reflected in the total crop yield. Field plots of winter wheat were studied for four years. The Enhanced Vegetation Index (EVI), regarded in literature as one of the best correlates of yield, was used to provide indirect information on yield. A method of identifying bare soils was developed, as this was needed to determine the erosion and accumulation characteristics of field plots. The results showed a statistically significant linear reduction in yield depending on the level of degradation, which was $16 \pm 1\%$ lower on degraded land. This is an essential basis for discussion with farmers and policymakers in designing anti-erosion measures and sustainable management.

Keywords: *Soil degradation, Water erosion, Crop yield, Aerial images, EVI.*

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APPLIED ECOLOGY - INTERACTION OF HUMAN SOCIETY WITH NATURE – NEEDED AND ABSENT FIELD OF RESEARCH

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Abstract

Mankind substantially affects ecosystems of our planet. Interestingly, most current ecology textbooks do not talk much about human impact on ecosystems, but rather explore how individual species, populations, or communities will interact and evolve on their own. This approach is certainly justifiable, because most ecological relationships evolved from an evolutionary point of view before the rise of human civilization, and so they somehow do not need man for their natural functioning. If we want to understand the functioning of the current global ecosystem, we cannot ignore human influence. Here we introduce a new book Applied ecology which specifically focussed on interaction of agriculture, forestry and fisheries with natural systems. This interactions as described in the book are extremely variable and will be introduced only briefly. In this stalk we particularly focused on consequence of detachment of producers from users of product in agriculture but also in forestry and fisheries. Division of labour is one of the basic precondition for development of human society, this require intensification of production so one worker producing food (wood, fibre etc.) can supply needs of larger amount of consumers. This detachment cause increase of demands of consumers, which now sees product only in terms of their price and lead to future increase of consumption, which increase demand on producers. This lead to increase in intensification, using animal power, machines, fertilizers, this decrease EROI and make production of food and other goods energetically more expensive. This is even enhanced by fact that food and other product is less and less sold directly by primary producers but retailers. Increase intensification, specialization on certain product, which cause spatiotemporal homogenization, reduction of crop diversity and crop rotation etc. This environment is further modified by various socioeconomic intervention. As already mentioned this is in large extend affected by detachment of consumers from production which perceive product by certain attribute of product quality and price, and have no or very limited information how the product was produced and what were environmental and other consequences. There are various attempt how to reduce this attachment and made consumers more closely connected with production. Those include various form of organic production, community agriculture or hobby farming. All of them are however affecting relatively small proportion of market. Here could be potentially important role of customer information and awareness. Providing information about conditions of production, together with education of public may allow customers to include this information in their decision. This already work in some cases such as in egg production when awareness of society is high produces and retailers provide quite clear information about technology which has been used. In other cases retailers try to avoid product which include socially problematic issued such as rainforest deforestation. But in many cases such clear information is missing and or customers are not aware about consequences of this information. Elaborating simple system that will enable to consider information about production technologies and origin in their marked choice.

Keywords: applied ecology, interaction, humans, nature.

POTENTIAL OF ORCHARDS AS HOT SPOT HIBERNATION SITES IN LANDSCAPE FOR INVERTEBRATE PREDATORS

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Abstract

Biodiversity is a tool contributing to agroecosystem functioning and agriculture play an important role in biodiversity conservation. Agricultural intensification in the last decades has contributed to a dramatic decline in biodiversity, loss of beneficial arthropods, and their ecosystem service. Invertebrate predators in agricultural landscape contribute to pest suppression. The critical points for surviving of their population is hibernation and a sufficient number of overwintering sites. However, they are vanishing due to landscape simplification and overuse of agrochemicals. Orchard agroecosystems enable maintaining biodiversity also in the surrounding landscape. We investigated hibernating arthropod assemblage in the fallen leaves in three types of fruit orchards during two winter seasons. Environmental characteristic of each sampling point were recorded. Arthropods were separated from the leaves in the laboratory and determined. We found 1280 individuals at an area of 168 m² from eight arthropod orders. Predators with potential to suppress pests were dominant with 1017 individuals and we found only 10 pests. The vast majority of predators were spiders (787 individuals) and coccinellid beetle (215 individuals). Environmental conditions and ecological traits of the predators were evaluated. Spider assemblage differs according to the type of orchard, year, and microhabitat characteristic of the ground. Coccinellids were specific for the orchard type. Our results emphasize importance of leaf litter on biodiversity conservation. It is important to find ways for preserving invertebrate communities while preventing the spread of leaf-borne fungal diseases.

Key words: *biodiversity, fruit orchards, fallen leaves, hibernation, predatory arthropods.*

BEEKEEPING IN RWANDA: CHALLENGING AND PROMISING

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Abstract

Rwanda is a landlocked country situated in Central Africa. Rwanda's total area is 26,338 Km². Most of this area is green, ranges from dense equatorial forest in the north-west to tropical savannah in the east, and farmlands are present in all regions. Rwanda is a tropical rainy country. However, the temperature is quite pleasant most of the year because it is "*The Land of a Thousand Hills*". The Altitude ranges from 1000m to 4500m above the sea level. The data about beekeeping in Rwanda is rare. This study has been performed to survey the beekeeping practices, resources, and challenges in Rwanda. It is a screening of what was and is happening, and what will be predicted. A data mining strategy has been followed, including site visits, in-person interviews and discussions, literature review, and official data browsing. The kept bees are the endemic African subspecies, and importing live bees is officially not available. Hiving is extremely traditional depending on log hives made from banana dry leaves. The hives are hanged high on the trees (5 – 15 m above ground). Beekeeping practices are quite basic and traditional. Beekeeping knowledge is mostly shared orally within families. Modern hives, equipment and practices are taking the place of traditional ones slowly. The main challenges facing modernizing beekeeping is the lack of knowledge, and the high cost of modern beekeeping hives and equipment. The capacity building is urgently needed. The future of beekeeping is promising because of 1) the huge floral resources 2) the strong and widespread interest from the public and officials 3) the increased support from the government and non-profit organizations. Organic beekeeping resources are rich because of the virgin environments. Rwanda is expected to lead many neighbor African countries in beekeeping modernization.

Keywords: *Rwanda, traditional beekeeping, beekeeping in Africa, African bees, log hive.*

RAPID URBAN EXPANSION AT THE EXPENSE OF NATURE IN FAST GROWING CITIES OF ETHIOPIA, JIMMA

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Abstract

Urbanization threatens biodiversity mostly in developing nations where rural-urban migration is high and urban planning is poor to consider nature conservation. Lacks of adequate information on how urban expansion impacts ecosystem service is exacerbating the problem making designing migratory actions difficult. Here we quantified how Jimma city, a typical fast growing town in Ethiopia, expanded over the past 35 years, predicted the change for next 50 years and mapped priority areas for conservation. Landsat satellite images of 1985 and 2020 were used to map major land cover types and to quantify changes, Markov chain model was used to predict future land cover changes, and GIS-based multi-criteria were used to identify conservation priority areas. Our results showed adverse effect of urban expansion on the natural habitats. Over the past three decades, built-up areas were expanded by sevenfold (721%) while cropland was expanded by 34%. However, natural habitats dropped considerably: forest by 39%, grassland by 20% and wetland by 28%. Our projection of the current trend to the next 50 years indicated the built-up areas might further increase by fourfold 436%. While water body, wetland, natural forest and cropland are predicted to decline by 81%, 40%, 42% and 55%, respectively. Our study indicated the importance of delineating at least 9040 ha of the land within city administration, which we categorized as high priority areas for conservation. To build resilient and sustainable urban centres, there is a demand for improved urban policy and planning that supports integration of urban development and nature conservation.

Key words: *Biodiversity conservation, urbanization, urban planning, urban biodiversity, urban ecosystem.*

GENTIANA LUTEA RHIZOMES: FROM ACTIVE BIOMOLECULES TO PROCESSED FOOD SYSTEMS

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Abstract

Gentiana lutea is a perennial plant species the *Gentianaceae* family of yellow gentians that can grow naturally in medium-altitude mountains (800 to 2500 m), and that has been human domesticated in cultivated places. In function of its geographical origin and its growing conditions, *Gentiana lutea* accumulates in its rhizomes a high quantity and diversity of active odor and odorless biomolecules that found several applications in the sectors of herbal medicines, animal nutrition, agri-food, cosmetic applications, and more recently in agroecology. Among its high value-added biomolecules, gentian seco-iridoids have gained human attention for their bitter and health properties. Those can be easily quantified by means of analytical chemical tools in the rhizomes but their content in human-consumed *Gentiana lutea*-transformed products, is largely impacted by biological and physico-chemical processes. This presentation will be focused on underlying the chemical (bitter composition and volatile) and physico-chemical (mid-infrared spectroscopy) composition of *Gentiana lutea* sampled from the four French mountains (Massif Central, Jura, Pyrénées and Alpes). Such work is part of the framework of the French funding for sustainable development and land-use planning of *Gentiana lutea* resource. Our presentation will be divided in two parts. The first one will be dedicated to the presentation of an unprecedented classification of *Gentiana lutea* rhizomes based on their bitter constituents by means of mid-infrared spectroscopy and chemometric guided tools. This rapid and non-invasive technique offers an interesting way to discuss geographical origin and plant growing conditions (wild vs cultivated). In a second part, *Gentiana lutea* rhizomes biomolecules will be discussed in terms of existing transformation processes: (i) physically by heat treatment, (ii) biologically by fermentation and (iii) chemically macerated in Chardonnay wines and goat milk whey, to propose novel sensory and healthy processed food products for human consumption.

Keywords: *Gentiana lutea*, seco-iridoids, food processes, sensory perception

LINKING BEEKEEPERS' AND FARMERS' PREFERENCES TOWARDS POLLINATION SERVICES IN GREEK KIWI PRODUCTION SYSTEMS

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Abstract

Kiwi, a highly insect-pollinated dependent crop is in the cornerstone of the Greek agricultural sector rendering it the 4th biggest producer worldwide with an expected production increase. This extensive transformation of the Greek arable land to kiwi monocultures in combination with wild pollinators' decline raises questions for the provision of pollination services and consequently, for the sustainability of the sector. Indeed, a substantial decline of insect pollinators has been witnessed across Europe mostly due to increased pesticides use and natural habitats deterioration. Consequently, if the above transformation is further aggravated kiwi yields may start to fall due to inadequate pollination services, with serious negative consequences on the sector. In many countries, this shortage of pollination services has been addressed by the installation of pollination services markets, as happened in the USA and France. In fact, in France, in the last years, a larger market for managed pollination services has been established, where farmers rent beehives as a commercial input in their production system. Therefore, the main objective of this study is to identify the opportunities and challenges to establish a pollination services market in kiwi production systems in Greece. To do so, we conducted two separate quantitative surveys, one for beekeepers and one for kiwi producers in order to explore i) the possibility of collaboration between the stakeholders, ii) stakeholders' perception of pollination services, and iii) stakeholders' decision making regarding pollination services. Findings indicate that an unofficial pollination services market exists between the two stakeholders. However, it is not satisfactory for beekeepers. Moreover, we identified and analyzed their perceptions regarding pollination services and their mode of action. Consequently, our findings constitute a strong basis for further collaboration between the two stakeholders as well as to promote effective policy measures for the protection of wild pollinators.

Keywords: *Greece; pollination service; Actinidia chinensis; domestic bee, Apis mellifera*

ASSESSMENT OF REGIONAL IRRIGATION WATER REQUIREMENTS AND ACTUAL SUPPLY IN BAODING, CHINA

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Abstract

Nowadays, water resources scarcity has become a severe issue that interferes with economic, social, and ecological development. As the most significant use of water resources in agriculture, irrigation plays a crucial role in ensuring agricultural production when rainfall is insufficient to maintain the growth of crops. In this paper, estimation of water resources in irrigation practices was carried out in Baoding since the area suffers from water scarcity, and the situation there is worsening, especially after the founding of Xiongan New District. This study aimed to evaluate the supply and demand balance of irrigation at the municipal and county levels through the climate information and crop pattern summarization in Baoding. Data provided by Agricultural Machinery Bureau was integrated with CLIMWAT 2.0 to compute crop water requirements, irrigation requirements, and irrigation schemes in CROPWAT 8.0. Results show that an estimated sum of 1881.3 mm annual crop water requirements comprising the vast majority of crops in agricultural production led to 1493.5 million m³ irrigation requirements, creating an irrigation deficit of 119.2 million m³. The greater cutdown on annual water supply compared to the irrigation requirements led to a consecutive exacerbation of annual irrigation deficits. Suggestions including physical and political measures were provided to improve the current situation in Baoding.

Keywords: *Crop water requirements, Irrigation requirements, CROPWAT 8.0, Baoding.*

THE EFFECT OF DROUGHT STRESS ON NUTRIENT UPTAKE AND TRANSLOCATION ON SERPENTINE SOILS

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Abstract

The aim of this experiment was to identify how the drought stress affects the nutrient uptake in *Odontarrhena chalcidica* (Janka) Španiel & al. Climate change is a very serious threat to agriculture and has a negative impact on the serious problem of drought stress. On the other hand, serpentine soils are a negative factor for agriculture. This experiment was established in order to investigate the effects of serpentine soils on nutrient uptake and translocation under deficit irrigation treatment. The plant species that was used in the experiment is *Odontarrhena chalcidica* (Janka) Španiel & al., a potential candidate for use in Ni Agromining. Serpentine soils are characterized by very low levels of essential macronutrients (N, K, P), a Ca/Mg ratio < 1 and high concentrations of heavy metals such as nickel (Ni), chromium (Cr) and cobalt (Co). Total available macronutrient (Ca, Mg, K) and micronutrient (Fe, Mn, Ni) conservation on serpentine soil and plant material were analysed by ICP-Plasma Spectrometer. The results indicated that serpentine soil contains high levels of nickel. The uptake and the allocation of Ni, as well as that of some other essential nutrient elements (Ca, Mg, Fe, Mn), to upper parts decreased while K recorded increase in the upper parts. Moreover, the absorption of Mg remained the same. Our results showed that Ni significantly increased especially in the upper parts by increasing water stress. The levels of Ni were lower under no deficit irrigation treatment. These data need further support.

Keywords: Agromining, nutrient uptake, *Alyssum murale*, drought stress.

HEAVY METALS IN SOILS FROM INTENSE INDUSTRIAL AREAS IN GREECE: A REVIEW

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Abstract

Soil pollution from industry is a major problem the world is facing today. Even low levels of contaminants in the environment pose a risk due to potential accumulation at higher trophic levels, a process called biomagnification. The effects of pollutants cause imbalances in ecosystems resulting in a negative impact on all organisms directly or indirectly. Greece, like most countries around the world, faces intense soil contamination in some areas caused by industrial activity. These areas are spread over almost all of the country and we find through literature that the main problem is heavy metals. The most contaminated areas are Halkidiki, Ptolemais, Lavrio, the industrial areas of Thessaloniki, Athens and Magnesia. Heavy metals produced by industries of these areas are mainly lead (Pb), cadmium (Cd), mercury (Hg), Titanium (Ti), Selenium (Se), antimony (Sb), Arsenic (As) and Nickel (Ni). Exposure of people to these pollutants can have a significantly negative impact on their health, thus soil remediation is necessary. Phytoremediation is an in situ environmentally friendly method that uses plants to remove soil pollutants. The best phytoremediation techniques for heavy metal contamination are: Phytoextraction involves the extraction of metals from the plant roots and their displacement into shoots and phytostabilization that uses plant roots to limit contaminant mobility and bioavailability in the soil.

Keywords: *Heavy metals, soil contamination, Industry pollution, Phytoremediation*

THE POTENTIAL ROLE OF UNGULATE BROWSING IN MAINTAINING RESTORED MOUNTAIN MEADOWS

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Abstract

Grasslands are threatened by spontaneous succession leading to woody encroachment, although they of middle mountain regions are among the most diverse habitats of the Carpathian Basin. It is an important task of nature conservation to preserve these diverse habitats by suppressing the woody encroachment and to create new open habitat patches by mechanically removing the shrub. The main goal of this study was to investigate the effect of the wild browsers' preference for woody species, which potentially plays a role in shrub encroachment. Study site is located in the Mátra mountains, North-Hungary, where three study sites were selected within the *Fagetalia* belt: two sites recently restored by scrub removal with different post-restoration management and a semi-natural grassland as a control site. All of the sites were available for wild ungulate grazing. 50 sampling points was recorded at each study site, describing their vegetation and browsing data and using curcular plots of 4 m². The highest shrub cover was found in the clearing that was grazed only by wild ungulates. According to the linear regression analysis, shrub cover significantly increased the abundance-weighted nutrient (NB) and water (WB) scores and decreased the naturalness value (SBT). On top of that, we found that an increase of shrub cover significantly decreased cover and species richness of grassland specialists, but increased weed cover. Most of the woody species were browsed in relation to their abundance except several *Rubus* and *Acer* species, which were non-preferred. Our results highlight that shrub encroachment has a negative effect on semi-natural grasslands and that besides wild ungulate browsing, additional management is needed to preserve these extremely diverse habitats.

Keywords: *Food waste, Online survey, Household behavior, Morocco.*

MORPHOTAXONICAL INVESTIGATION OF FESTUCA TAXA ACCORDING TO HORTICULTURAL APPLICABILITY

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Abstract

During this survey, two potentially horticulturally usable *Festuca* species was analysed: *Festuca wagneri* and *Festuca tomanii*. The main questions were the following: are they usable in an urban environment? Specimens of the two taxa, which were planted either into normal garden soil or into pots differed greatly. 30 specimens of each taxa were planted into similar environment for the sake of taxonomic and morphologic analyses. *Festuca tomanii* specimens were uniform, but *Festuca wagneri* formed clearly distinguishable taxonomic groups. Specimens of *Festuca tomanii* were usually larger and more uniform. Though the average lengths of leaves and inflorescence stems tended to be higher on the soil mixed with perlite, the coverage values were lower on it. Several types were selected from them, which could be useful in horticultural practice. These were named and described as such: 1. leaves and inflorescences both stand up densely; 2. generative shoots bend apart; 3. dense but short „dwarves”; 4. Very tall with spreading inflorescence with a particular lilac, antocianic colour on the nodes. These groups were expanded with the colour of the specimens, so green, grayish and silvery variants can also be separated. The tissue differences were in line with their horticultural decorative values and the differences in the inflorescence parameters. The diversity of *Festuca wagneri* showed well in this survey, and this taxon's parameters would be also useful in horticultural practice. The survey was supported by OTKA K-125423.

Keywords: *Festuca wagneri*, *F. tomanii*, tissue

SANDY GRASSLANDS ALONG THE DANUBE IN THE CARPATHIAN BASIN

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Abstract

We examined the sandy grasslands appearing in the steppe-forest-steppe vegetation, in the central part of the Carpathian Basin along the Danube. We studied the grasslands in terms of coenology, putting great emphasis on dominant *Festuca* taxa. The survey was conducted on 4 different locations in the Carpathian Basin. Cover of dominant grass species was used as indicator value. Pedological background was also examined. *Festuca vaginata* grassland is an open vegetation type based on its coenosystematic composition and ecological values. It grows on a very weakly developed calcareous soil with sandy texture, the lowest organic carbon (0,2%), and the highest carbonate content (11,3%). Where grasslands had been disturbed, *Festuca pseudovaginata* and the recently discovered *Festuca tomanii* appeared. These taxa were also found in forest patches. The soil under *Festuca pseudovaginata* was more developed, in the surface horizon with higher organic carbon content (1,1%) and lower carbonate content (6,9%). *F. pseudovaginata* is endemic in the Pannon region. The most developed soil profile under *Festuca wagneri*, the presence of deep, the humus rich soil material from deflation and degradation. Due to significant changes in the vegetation in the last few hundred years, the central sandy grassland, forest-steppe areas of the Carpathian Basin have become mosaic-like, but the present survey affirmed that several patches of the original vegetation have remained. The dominant *Festuca* taxa of these vegetation types are good indicators of the changes in the vegetation and their ecological background.

Keywords: *Festuca vaginata*, pedological analysis, diversity

ASSESSMENT OF BIOLOGICAL TREATMENT FOR ARSENIC REMOVAL FROM WASTEWATER OF SARCHESHMEH COPPER COMPLEX BY LEMNA MINOR AND CYPERUS PLANTS

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Abstract

Pollution caused by mining wastewater from concentrate manufacturers by smelting companies is the most important pollution of the mining operations. The wastewaters from the Sarcheshmeh copper mine complex have destructive effects on the soil, air, surface water, and groundwater of Sarcheshmeh. A possible solution for this problem is phytoremediation using hyperaccumulating plants. This study was carried out to evaluate the effects of nano -titanium dioxide (TiO₂) and Ethylene Diamine Tetra Acetic Acid (EDTA) for improving the phytoextraction of As, Cd, and Cu uptake from industrial wastewater of Sarcheshmeh copper mine by Lemna minor and Cyperus plants in the laboratory. In the present study, seven treatments including T1: irrigation with potable water, T2: irrigation with industrial wastewater, T3: irrigation with industrial wastewater and applying 2 gr/kg EDTA, T4: irrigation with industrial wastewater and applying 200 mg/kg nano-TiO₂, T5: irrigation with industrial wastewater and applying 300 mg/kg nano-TiO₂, T6: irrigation with industrial wastewater and applying 2 gr/kg EDTA and 200 mg/kg nano-TiO₂, T7: irrigation with industrial wastewater and applying 2 gr/kg EDTA and 300 mg/kg nano-TiO₂ were evaluated. Based on the results, the average growth rate in treatments ranged between 8 and 22.8 gr/m² day for L.minor and from 1.9 to 3.5 gr/m² day for Cyperus. The maximum value of As accumulation in L.minor was obtained as 382.5 mg/kg d.wt for T4, while it was 789.8 mg/kg d.wt for T5 in Cyperus. Also, the maximum value of Cu accumulation in L.minor and Cyperus was measured as 240.7 mg/kg d.wt for T2 and 1045.2 mg/kg d.wt for T4, respectively. The maximum of As removal rate for L. minor calculated 1785.9 kg/ha year with a removal potential of 54.8% in T5, while it was 989.6 kg/ha year with a removal potential of 58.7% in T5 for Cyperus.

Keywords: *Translocation factor; Bio-concentration factor; Phytoremediation; Environment; Nano-TiO₂*

EVALUATION OF SOIL AND WATER CONSERVATION MEASURES IN BIOLOGICAL REHABILITATION OF FARMLANDS IN NIMROOZ, SISTAN, IRAN

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Abstract

Currently mis management and non-scientific of water and soil resources caused that the most of country in the world facing to water scarcity and erosion. this condition according to un implement of integrated watershed management, by destroy water and soil resources especially in arid area were caused destroy environment and expansion of desert areas, that has caused many problems for residents of these areas too. So, to manage water and soil resource its need to use approaches of watershed management science by applicate the water and soil conservation methods by consideration the relationship between plant, water and soil for make a ecological balance in watershed. So, the aim of this study was evaluation of soil and water conservation measures in biological stabilization of low yield fields in Sistan area. The study area is located in the southeast of the country and north of Sistan and Baluchestan province and within the city of Nimroz and located at an altitude of 480 meters above sea level. The experiment had been conducted in a randomized complete block design including: treatments of plants species (1= Citrullus colocynthis, 2= Hibiscus tea), irrigation methods (traditional, subsurface irrigation, buried clay pot and waterbox irrigation methods) and the soil conservation methods (1= sand cover, 2=nanoclay). To evaluate the performance of irrigation methods the amount of water consumption and water use efficiency (WUE) for each treatment were measured. Also, by installing thermometers and probes at depths of 10, 30 and 50 cm Soil temperature and humidity were measured (using TDR). Also, at the end of the experiment to investigate soil physico-chemical characteristics and some erodibility indices, were sampled from different depths. According to the results there was significant different at 5% level on amount of water used between treatments. The highest amount of water consumption (equal to 4652/85 m³/he) was observed in witness treatment of Hibiscus tea (V1SI) and the lowest water consumption equal to 242/3 m³ per hectar and was related to treatment whit Citrullus colocynthis and nanoclay with waterbox irrigation (V2S2I1). Finding indicate that the highest number of water use efficiency of biomass related to V2S2I1 treatments that equal to 13739.7 gr/m³ and the lowest number of water use efficiency of biomass equal to 14/1 gr/m³ and related to V1SI treatment. investigating chemical characteristics samples shown that the lowest amount of SAR, Na, Ca+Mg, cations and the highest amount of organic matter that measured related to V2S2I1 treatment. Also, the result show that the Middleton index significantly were decrease compare to other treatment in V2S2I1 treatment. Conclusion: According to the result of this study, application of soil and water conservation measures that used in this study, by decrease the water consumption and provides the required moisture to the plants, improved the physicochemical characteristic and some soil erodibility.

Key Words: *Soil Moisture, Nano-clay, Erosion, Irrigation method*

INTER-STORM VARIABILITY OF SUSPENDED SEDIMENT YIELD

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Abstract

Studying variation of suspended sediment yield (SSY) is an essential tool in analyzing hydrological watershed behavior leading to success in proper watershed management. Nonetheless, such important investigations are lacked. The present study was therefore conducted in the Galazchai Watershed in West-Azerbaijan Province, Iran, ca. some 103 km², to analyze the SSY of 38 observed storm events from 29 October 2011 to 31 March 2019. Towards that, water discharge and suspended sediment concentrations were recorded at one-hour intervals at storm basis. The SSY amounts were then calculated through incorporating suspended sediment concentrations and corresponding flow discharges. The results showed that the SSY varied from 0.93 to 7018.62 tons per storm in the study events. The amounts of SSY in 16 storm events were <50, in 13 storm events were between 50 and 150, and in other nine storm events were >300 tons verifying the denudation rates from some 0.0001 to 0.68 t.ha⁻¹.storm⁻¹. The highest value of SSY was related to the first rainfall in autumn after a severe drought season in summer and the lowest amount of SSY was associated with low-intensity rainfall. The mean SSY value from 38 storms was 520.42 t.storm⁻¹ and the coefficient of variation was found to be 301.12%. The results showed that the amount of SSY at storm basis is highly variable mirroring various conditions governing the study storm events. It further proved changing fluvial behavior of the watershed whose minute study is essentially needed for the sound management of the watershed resources.

Keywords: *Integrated Watershed management, Sediment load, Sediment graph, Temporal variation.*

USING DUBININ-RADUSHKEVICH ISOTHERM TO INTERPRET CADMIUM SORPTION ON AGRICULTURAL PRUNING RESIDUE BIOCHAR

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Abstract

Among numerous sorption isotherm models, Dubinin–Radushkevich isotherm was developed to account for the effect of the porous structure of the adsorbents. This model did not consider a homogeneous surface or constant adsorption potential. In this study, we aimed to characterize the cadmium (Cd) sorption behavior on biochar derived from grape and apple pruning residues (GPR and APR, respectively). Consequently, batch experiments were carried out with increasing levels of initial Cd concentration (0 to 200 mg L⁻¹) under different shaking times (0 to 240 min) and temperatures (10, 20, 30, and 40 °C). The maximum Cd sorption capacities of 57 mg g⁻¹ and 49 mg g⁻¹ were calculated for GPR and APR biochars, respectively, indicating the higher sorption capacity of GPR in comparison with the APR biochar. The sorption energy parameter (E) of Dubinin–Radushkevich isotherm (4.37 and 4.05 kJ mol⁻¹) and negative Gibbs free energy (ΔG) values (-15 to -19 kJ mol⁻¹). The entropy (ΔS) and change in enthalpy (ΔH) were found to be 1.57 J mol⁻¹ K⁻¹ and 0.22 kJ mol⁻¹ for GPR biochar and 1.50 J mol⁻¹ K⁻¹ and 0.21 kJ mol⁻¹ for APR biochar reflecting an affinity of Cd on the biochars. This study demonstrated the feasibility of the biochars derived from grape and apple pruning residues to be as a potential low-cost adsorbent for Cd removal from aquatic systems. Furthermore, the sorption energy parameter (E) of Dubinin–Radushkevich isotherm, negative Gibbs free energy (ΔG), and positive enthalpy change (ΔH) indicated physical adsorption and spontaneous and endothermic nature of Cd adsorption by the biochars respectively.

Keywords: *Biochar, Adsorption isotherm, Cadmium, Grape and apple pruning residues, Thermodynamic.*

THE USE OF RESPONSE SURFACE METHODOLOGY FOR MODELING OF LEAD SORPTION BY SEPIOLITE

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Abstract

Lead (Pb) as a toxic metal has adverse effects on human health, which include growth retardation, cancer, and damage to the nervous and heart system. There are different methods for reduction of water pollution and the removal of heavy metals from water. One of them is sorption by using organic and inorganic adsorbents such as sepiolite. This study aims to investigate the sorption of Pb by sepiolite as an inorganic adsorbent and optimize process variables (initial concentration, pH, and ionic strength) using Response Surface Methodology (RSM) and Box–Behnken design (BBD). In the experimental design model, initial concentration (0-200 mg L⁻¹), pH (3-6), and ionic strength (0.01-0.06 mol L⁻¹) were taken as input variables. Results showed that the sorption of Pb intensified by increasing initial concentration and pH, but ionic strength had an inverse effect. The sorption of Pb ions onto the sepiolite minerals was lowest at pH=3 and IS=0.06, but increased with an increase in pH and initial concentration of the solution. High value for R² (0.99) and adjusted R² (0.99) showed that the removal of Pb can be described by the response surface method. One-way ANOVA showed (p< 0.0001) that the quadratic model is the best model for determining the interaction variables. According to optimization results, the sorption of Pb was maximized when pH: 6, concentration: 200 mg L⁻¹, and ionic strength: 0.02 mol L⁻¹. The predicted adsorption at these settings was obtained 44.4 mg g⁻¹ for Pb. The model revealed that initial concentration and pH were the most effective parameters for the response yield (adsorption by sepiolite). According to the results, sepiolite showed a greater efficiency for sorption of Pb from aqueous solutions, also usage of sepiolite as an inorganic adsorbent due to its low cost and abundance can be economically justified.

Keywords: *Box-Behnken design (BBD), Heavy metals, Sepiolite, Water pollution.*

POTENTIAL ASSESSMENT OF WATER HARVESTING FROM LOCAL WASTEWATER TREATMENT PLANTS (CASE STUDY: ROTATING BIOLOGICAL CONTACTOR, RBC)

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Abstract

In dry regions, the reuse of treated wastewater plays a significant role in the management, operation, scheduling, and utilization of the water resources management regarding the sewage treatment plants. In designing and operating such plants, it is essential to measure and forecast the harvested water from wastewater plants and balance the groundwater depletion with these newly produced waters. In this study, potential water harvested by local wastewater treatment plants, Rotating Biological Contactor (RBC) is determined and balanced with water requirement of plants. Based on the design basis of RBC, the production ratio of 80 % is used and the produced discharge ranges from 4 up to 8 litres per second, with 140000 cubic meters per year. To quantify the balancing between RBC produced reuse water and irrigation water requirements, a plant-by-plant water requirement is calculated and the operation rule of groundwater wells in the case study is determined and proposed as an action plan to the operator of wells. Based on the results it was observed that the RBC can supply two times of pistachio orchard (23 hectares) irrigation requirements or 70 percent of the landscape and green space water needs.

Keywords: *water harvesting; wastewater reuse; Rotating Biological Contactor (RBC); irrigation requirement*

EFFECTS ON PHOSPHORUS ADSORPTION BEHAVIOR IN SALINE AND NON-SALINE SOILS OF LAKE URMIA BASIN

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Abstract

Study of sorption isotherms is one of the important methods for assessing the phosphorus status of soils, which can provide useful information about adsorption P and the factors affecting it. A batch experiment was performed with phosphorus concentrations (0 to 35 mg/l) in two soils with different electrical conductivity (EC) (2 and 15 dSm⁻¹) by a variety of biochar treatments including simple apple-grape biochar (BC), rock phosphate- biochar (BC-RP), enriched-biochar (BC-H₃PO₄-RP) and (BC-HCl-RP), triple superphosphate (TSP) and control (Cont). The results indicated that phosphorus sorption capacity varied between the soils. Biochar treatments were effective in reducing the phosphorus adsorption of both soils. Due to BC-H₃PO₄-RP and BC-HCl-RP treatments, the maximum phosphorus adsorption of soils decreased, in S1 soil by 14 and 23 % and in S2 soil 26 and 19%, respectively. Enriched biochars significantly reduced the buffering indices of both soils, which indicated phosphorus adsorption significantly decreased and increased the availability of phosphorus for the plant. Standard phosphorus requirement of S2 soil was lower than S1 soil by both equations therefore, enriched biochar can be an effective strategy to increase the phosphorus availability and reduce the use of chemical fertilizers in saline and non-saline conditions; however more field studies are needed for a clear understanding of the potential of P-enriched biochar as a fertilizer alternative.

Key words: *Biochar, Phosphorus adsorption, Enrichment, Saline soil.*

EFFECT OF PRUNING WASTE BIOCHAR AND MICROBIAL ACTIVITY ON SELECTED SOIL NUTRIENTS BIOAVAILABILITY

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Abstract

In order to increasing the yield of crops grown in nutrient-poor calcareous soils, the combined effects of biochar addition and inoculation with plant growth promoting rhizobacteria (PGPR) and arbuscular mycorrhizal fungi (AMF) on wheat growth and soil properties were investigated under rhizobox conditions. Measured soil properties included pH, electrical conductivity (EC), organic matter content (OM), the availability of nutrients including P, Fe, and Zn in the rhizosphere, and the uptake of these elements by plants. Combined biochar addition and microbial inoculation were shown to significantly increase the concentration of available forms of studied nutrients in the soil when compared to non-biochar treatments. The highest soil pH was observed following biochar addition without microbial inoculation. The EC following biochar addition and PGPR inoculation was significantly higher than the other treatments, and the soil OM content was highest when combining AMF inoculation with biochar addition. The available P content after AMF inoculation combined with biochar addition was 27.81% higher than the control conditions, and AMF inoculation increased Fe and Zn bioavailability by factors of 2.38 and 1.29, respectively, when combined with biochar addition relative to AMF inoculation alone. The simultaneous biochar addition and PGPR inoculation significantly increased P uptake by the plants. The highest shoot Fe and Zn uptake rates were observed after a simultaneous application of biochar and PGPR inoculation. Under these conditions, shoot uptake was higher than seen when combining biochar addition with AMF inoculation. In general, it can be concluded that combining inoculation with growth-promoting bacteria and biochar addition can effectively improve nutrient availability to plant and soil conditions.

Keywords: *Organic matter, Pruning waste, Nutrient availability, Rhizobox.*

IMPORTANT DRIVING FORCES DETECTION ON GULLY EROSION, (A CASE STUDY OF CHAHARMAHAL AND BAKHTIARI PROVINCE, IRAN)

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Abstract

Gully erosion is one of the most important types of water erosion that causes the destruction of agricultural and range lands in arid and semiarid landscapes. The main aim of present study is to identify the most important factors affecting the gully erosion development in Chaharmahal and Bakhtiari province of Iran and to obtain appropriate solutions to control this type of erosion. The areas affected by gully erosion in the study area were identified using field visits. Using the geographical location of identified gullies a map of spatial distribution of areas affected by gully erosion in the study area was prepared. Gully volume as a dependent variable and factors such as sodium ratio, percentage of soluble salts, percentages of clay, silt and sand in gully area, gully floor slope, gully upstream slope, mean rainfall and vegetation density as independent variables were considered. The measured parameters were statistically analyzed. The results showed that the three factors of gully upstream slope, the percentage of soluble salts in the soil and the density of vegetation with a coefficient of determination of 0.94 had the greatest effect on the gullies development in study area. The slope of watershed above the gully forehead (gully upstream slope) alone accounts for 86% of the changes in gully erosion volume. The main reason for this result can be attributed to the flooding of this factor and the speed of surface runoff.

Keywords: *Aggregate stability, Land degradation, Gully erosion, Soil texture, Vegetation.*

MODELING OF CULTURE CONDITIONS FOR ZINC PHOSPHATE SOLUBILIZATION BY ASPERGILLUS SP. APPLICATION RESPONSE SURFACE METHODOLOGY

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Abstract

Harnessing microorganisms' potential to solubilize Zn can play an important eco-friendly role in sustainable agriculture. However, micro-organisms' *in vitro* solubilization potential is strongly influenced by their culture medium's composition, which must therefore be optimized when screening and applying microorganisms as biofertilizers. In order to have modeling effects of varying levels of a carbon source (fructose, 5–30 g L⁻¹), a nitrogen source (ammonium sulfate, 2–10 g L⁻¹), and zinc phosphate (Zn₃(PO₄)₂, 2–15 g L⁻¹) on *Aspergillus*-mediated Zn release from the zinc phosphate, a central composite design (CCD) experiment with 20 combinations of surface variables and surface response method was used. The resulting model had high predictive ability ($R^2 = 0.9454$), and showed that the Zn₃(PO₄)₂ and (NH₄)₂SO₄ concentrations were the first and second most important factors for amounts of Zn released, respectively. The results also indicated that 14.6 g L⁻¹ fructose, 10 g L⁻¹ (NH₄)₂SO₄, and 15 g L⁻¹ Zn₃(PO₄)₂ was the optimal combination for maximizing Zn release under our culture conditions. It concluded that the study highlights the utility of response surface modeling for optimizing multiple cultivation variables when screening microbial taxa for solubilizing Zn, or maximizing other microbial activities.

Keywords: *Central composite design, Culture medium components, Insoluble zinc compounds, Optimization*

OPTIMIZATION OF PHOSPHORUS BIOFERTILIZER FORMULATION BY BACTERIA USING RESPONSE SURFACE METHODOLOGY

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Abstract

Phosphorus is one of the most vital macronutrients required for the growth and development of plants. Despite abundant amounts of phosphorus in parent material, the soil phosphorus availability is limited for plant. This study aimed to analyze and quantify the effect of different ratios of vermicompost, phosphate rock and sulfur on P solubilization and release by *Pseudomonas fluorescens*, and to identify optimal levels of those variables for preparation of an efficient biofertilizer. Twenty experiments were defined by the surface response method based on a central composite design (CCD), and the effect of various quantities of vermicompost, phosphate rock and sulfur encoded by -1, 0 or +1 on P solubilization was explored. The results revealed the high efficiency of the CCD model in estimating P solubilization ($R^2 = 0.9035$). Among the independent variables studied, linear effect of sulfur and organic matter (vermicompost), the quadratic of phosphate rock, interaction organic matter \times phosphate rock had the largest influence on the observed P solubilization rate. Statistical analysis of the coefficients in the CCD model revealed the positive effect of vermicompost, vermicompost \times phosphate rock, and phosphate rock \times phosphate rock in increasing P solubilization. The optimal composition for P solubilization was predicted to be 58.8% vermicompost, 35.3% phosphate rock and 5.8% sulfur, which would maximize P solubilization to 1684.39 mg.kg⁻¹ by *P. fluorescens*. The amount of dissolved phosphate was more than 90%. ANOVA confirmed the model accuracy and validity with respect to the *F* value (10.41), *P* value (< 0.001) and non-significant lack of fit.

Keywords: *Biofertilizer, Central composite design, Modeling, Phosphate solubilizing bacteria.*

EVALUATION OF THE EFFECT OF SIMULTANEOUS INSTALLATION OF TWO SPOILERS AND PIPE WEIGHT ON SCOURING UNDER HORIZONTAL TRANSMISSION LINES

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Abstract

The scouring phenomenon that occurs due to the interaction of water and soil in the vicinity of hydraulic structures leads to instability of transmission lines and increases the risk of pipe breakage. In order to prevent the possible destruction and breakage of transmission pipes, studies related to the erodibility conditions of the piping bed, scour reduction strategies and increased self-defense of pipes in the implementation of transmission projects are of particular importance. In this study, the effect of simultaneous installation of two spoilers on the transmission pipe and the effect of transmission pipe weight on scour under the transmission pipeline in two types of piping substrates were evaluated. The results of the present study showed that the simultaneous installation of two spoilers above and below the transmission pipe could be effective in reducing scouring and increasing self-defense and ultimately the durability of transmission pipes. In addition, it was shown that with increasing the weight of the pipe, the depth of self-burial of the pipe increases. If this method is used correctly, the probability of the occurrence of rugged phenomenon is reduced and the pipe will not be broken due to current-induced displacements. According to the numerical and laboratory results of this study, it can be concluded that the simultaneous presence of a spoiler (longitudinal blade) at the top and another one below the pipe to a large extent prevents the occurrence and formation of rudders and protects the pipe against scouring.

Keywords: *scour, spoiler, horizontal transmission pipe, self-burying.*

VULNERABILITY ASSESSMENT OF ROAD NETWORKS TO LANDSLIDE HAZARDS USING RANDOM FOREST ALGORITHM

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Abstract

Landslides are natural hazards that can cause catastrophic life-losses and damage to infrastructures and communities. In Iran, landslide exposure has been predominantly increasing in the Zagros Mountains, notably along the lifelines, such as the road network. Therefore, this study aimed to investigate the landslide vulnerability of the 1275-km road networks in the Chaharmahal and Bakhtiari province, Iran. The methodology relies on: first the mapping of landslide susceptibility using a machine learning methods Random Forest (RF). Second, the application of the analytic hierarchy process (AHP) method to compute the weight for four buffer zones (0-50, 50-150, 150-300, and >300 m) from the road network to produce a road exposure map to landslides. Combining the results of steps (1) and (2), we produced a map of the road-network risk to landslides by combining the landslide hazard map with the road network exposure map. Specifically, the roads of the Ardal and Kohrang counties have been found to be the most vulnerable to landslide risk. The results showed that 296 km of the road network was located in the “very-high risk class”. The results of this study could be useful for decision makers and civil engineering to better manage road networks in terms of landslide risk and community resilience in the aftermath of major landslides.

Keywords: *Mass movement; Rock fall; Natural hazards; Earth hazards; Machine learning.*

SATELLITE MONITORING OF TROPOSPHERIC NO₂ AMPLITUDE DURING COVID-19 PANDEMIC OVER IRAN

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Abstract

Tropospheric NO₂ pollutant and Nighttime light (NTL) are representative of human activities. COVID-19 lockdown reduced traffic volume and industrial activities which are the main sources of air pollution in the whole of the world. This study focused to quantify the annual and monthly change of NO₂ concentration and nighttime light in 5 metropolises of Iran before and during the lockdown especially in March, April, October, and November. The Tropospheric monitoring instrument (TROPOMI) images of Sentinel-5p was used for investigation of NO₂ column density in 2019 and 2020 and the variation of Nighttime light was monitored by VIIRS (Visible Infrared Imaging Radiometer Suite) images. The results showed that the most annual and monthly reduction of NO₂ levels has occurred in Tehran and Sari. The majority of metropolises showed an increase of NO₂ concentration in March and October and a decrease in April and November. A similar pattern of NTL change as NO₂ was observed in most metropolises. The correlation between NO₂ concentration and NTL was obtained from 0.66 to 0.75. According to the results, reducing traffic volume as the mobile source does not has an effective contribution in NO₂ emission in some metropolises of Iran which the stationary sources are dominant. These findings will help to better decision-making for controlling and managing air quality in country towns.

Keywords: *Air pollution, Nitrogen Dioxide, TROPOMI, VIIRS.*

PRIORITIZATION OF THE AFFECTING FACTORS ON LANDSLIDES: A CASE STUDY OF THE DOAB SAMSAMI WATERSHED, IRAN

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Abstract

Landslides are one of the most important natural disasters that affect human life. Landslides are caused by hydrological, geological and morphological conditions. These conditions, along with other environmental conditions such as land dynamics, land use, vegetation, human activities, earthquakes and the amount and intensity of rainfall, cause these natural phenomena to occur. In this study, using a Random Forest model (RF) and 12 main factors affecting landslide events in the watershed of the Doab Samsami Watershed in Chaharmahal and Bakhtiari Province in Iran, landslide zoning map in four categories of very high, high, medium and Low risk were determined. Using 96 recorded landslide events and environmental, human and climatic factors, an accurate RF learning model was implemented. The evaluation results showed that the landslide zoning map using the mentioned model has an accuracy of 84%. The results of this study showed that based on the Mean Decrease Gini(MDG), the most important factors affecting landslide in Chaharmahal and Bakhtiari Province include distance from fault, slope, distance from road, stream density and distance from river. The results of this study can be effective for better management of landslide risk and provide effective remedies for its control by decision makers. In other words, by carrying out the precise zoning of different areas from the point of view of sensitivity to mass movements and prioritizing the causes of these instabilities, limited budgets are concentrated in a targeted manner for priority control measures.

Keywords: *Slope instability, Landslide zoning,, Mass movements casual factores, Remediation measures*

WATERSHED HEALTH AND SUSTAINABILITY

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Abstract

The disturbance of human and environmental equilibrium has resulted in the destruction of watershed conditions today. Because of the important links between ecosystem services, a healthy and sustainable environment, and human well-being, watershed sustainability awareness is essential. As a result, the current study will first look at different dimensions of watershed health and sustainability. Following that, the use of watershed health assessment for practical applications will be presented, leading to watershed adaptive management. In addition, several examples of the application of watershed health and sustainability evaluations in various ecosystems will be provided. Finally, relevant conclusions will be formed in order to present decision/policy makers with roadmaps, with a focus on developing nations.

Keywords: *Ecologic Balance; Human Wellbeing; Sustainable Development; Watershed Health; Watershed Services.*

NOVEL BACILLUS THURINGIENSIS STRAINS AGAINST LEPIDOPTERAN PEST IN ISRAEL

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Abstract

Bacillus thuringiensis (Bt) strains produce a variety of Cry delta-endotoxins share toxicity against quite a few dipteran, lepidopteran, and coleopteran species. Bt is considered an useful and safe control agent. However, routine application of Bt in pest management could evolve a resistance to the Cry toxins. The objective of this study was to explore new strains of Bt that may expand the range of Cry toxins to cope with the insect pest populations that are initially less susceptible to Bt commercial products or has developed resistance. A total of 461 Bt field strains were screened against key target pests in agriculture and forestry. Five species of lepidoptera have been studied: *Thaumatotibia leucotreta*, *Apomyelois ceratoniae* and *Spodoptera littoralis* as agricultural pests, and *Thaumetopoea wilkinsoni*, *Thaumetopoea solitaria* as forest pests. The strains were examined in groups of five. Groups that showed mortality activity were separated into individual isolates. Each isolate was examined separately. Water and BTK (the commercial isolate) were used as a control. Our findings revealed nine isolates with a higher mortality activity as compared with commercial BT formulations. The two most promising isolated, K98 and K100, displaying highest lethal effect and wide target range were sequenced. Nine genes encoding new proteins have been identified. For two species of moths (*T.leucotreta* and *A.ceratoniae*), Larval mortality responding to recombinant *Escherichia coli* expressing a new cry1B. K100 which contains the cry 1B were defined as new species *Bacillus marginalis* and it is currently tested as an original product on a commercial scale.

Keywords: *Bacillus thuringiensis*, Strains, Cry, Lepidoptera, Isolated.

GROWING CONDITIONS OF SEAWATER SUCH AS TEMPERATURE EFFECT ON FATTY ACIDS CONTENT OF *ULVA LACTUCA* CULTIVATED IN SLEEVE SYSTEM OFFSHORE (ISRAEL)

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Abstract

The use of the high-value fatty acids (FAs), omega-3 and omega-6 from alternative source such as seaweed, could relieve the pressure from natural wild fish sources and reduce overfishing worldwide. This research was designed to explore the influence of seawater temperature (8, 20, and 30o C) and salinity concentration (3.5, 3.0, 2.5 and 2.0%) on the biomass production yields, lipids content, and FAs composition in the *U. lactuca* seaweed grown in plastic sleeves with the flow through artificial seawater in TRDC, Israel) during the years 2022. The *Ulva* species were identified as *U. lactuca* by DNA barcoding using *rbcL*, *ITS* and *tufA* markers indicating no detectable genetic alteration in all studied *U. lactuca* samples throughout the research period. A quantitative examination of the biochemical components in *U. lactuca* was performed. The results correlated with the high salinity and low temperature growing of *U. lactuca*, where the maximum content of polyunsaturated fatty acids was in 8 C and 3.5% salinity. PUFAs content was also correlated to low temperature and high salinity as well. When profiling the single fatty acids it was noticed that content of EPA, DPA and DHA increased when lower temperature and high salinity were obtained. The content of Omega-3 (n-3) was increased, and Omega-6 (n-6) was decreased by low temperature and high salinity, leading to decrease of the n-6/n-3 ratio as comparable. The desirable range for a balanced nutritional diet was 1-10.

Key words: *Ulva Lactuca*, Seawater salinity, seawater temperature, Omega-3

DYNAMIC INTERACTIVE WATER ALLOCATION CONCEPT: MORE MANAGEMENT FLEXIBILITY ALLOWS FOR BETTER WATER CONSERVATION IN TUNISIA'S MEDJERDA RIVER BASIN (MRB)

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Abstract

The increasingly adverse impacts of climate change such as droughts and floods are translated into a contingent liability to the community of users. Therefore, conventional water management practices must endure a shift toward integrative approaches, or maybe future water management must shift from building new water systems to better managing the existing ones. This paper looks into the water resource management aspects through an innovative management solution that takes into account the impacts of climate change. The study mainly focuses on water decisions made by water managers and heterogeneous parties when dealing with transboundary resources with multiple stakeholders' preferences. Applied to a real context, the Medjerda River in Tunisia is the perfect example of a transboundary basin with contradictory water use requirements between its upstream and downstream parts. We developed a dynamic interactive water allocation model that encompasses the water banking technique, which is making voluntary sells or buys of their water shares between parties in order to address the challenge of allocating the scarce surface water among competing uses while ensuring the sustainability of the natural resource. We developed a set of scenario analyses: two management scenarios that include the no water trade and the water banking scenarios, three demand scenarios that include a combination of steady, low, and high-water demand conditions, and three hydrological scenarios that include: dry, normal, and wet conditions, and one unique institutional scenario is considered in which the surface water and the groundwater are administrated separately (a non-conjunctive system). To examine the economic impacts of water banking management, we calculated the estimates for the cost of water shortages that will be induced to users during severe conditions in order to illustrate the magnitude of the expected economic damages based on the economic model. Results show that water banking can offset users' profit losses during severe conditions (i.e., drought). The water banking technique can improve the availability of water resources by optimizing the management, operation, and conservation of natural and artificial water storage systems and water distribution infrastructure. Banking on surface water sources allows the Tunisian government to minimize farmers' profit's lost from drought and optimize the water storage potential.

Keywords: *Water banking; Water management; Management flexibility; Water conservation; Hydro-economic models*

THREE YEARS MONITORING OF TOXOPLASMA GONDII CIRCULATION IN WILD ANIMALS OF SOUTHERN ITALY

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Abstract

Systematic surveillance of wildlife is important to help prevent zoonotic episodes that would jeopardize human health, and undermine biodiversity conservation and management. *Toxoplasma gondii* (*T. gondii*) is an important opportunistic zoonotic parasite that can infect all warm-blooded vertebrates, causing severe disease in immunocompromised humans and in cases of congenital transmission. Humans can be contaminated by ingestion of raw or uncooked meat or water, contaminated with oocysts. In our study we assessed the potential circulation of *T. gondii* in wild animals by performing a surveillance from different sites of Campania Region (Southern Italy). We monitored the presence of *T. gondii* from 2020 to 2022 in the scope of Regional Plans for Wildlife Surveillance. In details, 231 individuals belonging to different wild animal species found dead on the territory underwent necropsy and organs were analysed by Real-Time PCR for the detection of the parasite. Results showed that we detected *T. gondii* in 23.4 % (54/231) of animals tested. In particular: 27.1 % (16/59) foxes, 18.7 % (17/91) wild boars, 25 % (5/20) badgers, 23 % (3/13) wolves, 15.4 % (2/13) roe dears, 66.6 % (2/3) beech martens, 50 % (2/4) porcupines, 80 % (4/5) lemurs, 20 % (2/5) otters, 50 % (1/2) kangaroos. This outcome is a first step towards a better understanding of the wide distribution of this parasite in wildlife.

Keywords: *wild animals, Toxoplasma gondii, zoonotic, parasite.*

MICROPLASTIC POLLUTION AND LAND USE TYPE: THE CASE STUDY OF VOLTURNO RIVER

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Abstract

Microplastic pollution is an issue of great concern, posing a serious threat to all living species. This makes it necessary to identify and survey areas highly susceptible to plastic contamination. Marine and river ecosystem can provide important information about microplastic pollution generated by nearby activities. Indeed, due to their structure, texture and composition, sediments could act as sink for this emerging pollutant. Therefore, we analysed microplastics contamination of Volturno river (Southern Italy) sediments, one of the most polluted Italian river, as a result of chemical and livestock industries discharges and intensive agriculture. The aim of this study was to (I) monitor microplastic footprint and levels in the area and (II) to explore possible relationships between pollution and land use type. Sampling was carried out at the Volturno source, estuary and at the tributary points, with the aim of observing their contribution in the input of microplastics. Their extraction was performed by sequential solvents extraction-hydrolysis. Chemical analyses were conducted by Pyr GC-MS and HPLC, which allowed the quantitative evaluation of HDPE, LDPE, PS, PP, PET, Nylon-6 and Nylon-6.6. Results showed a widespread and variable contamination along the river. Moreover, high levels of PS contamination, which could be addressed with great probability to agricultural activities, were found. Samples were also subjected to a preliminary metagenomics analysis. Our interest was to assess whether microplastic contamination was significant enough to lead to alterations in the microbial community, thus assuming a relationship between the most represented microbial species and concentration/type of synthetic polymer.

Keywords: *Microplastic pollution, sediment monitoring, land use, solvent extraction, metagenomics.*

BIOTECHNOLOGICAL COMBINATION FOR CO-CONTAMINATED SOIL REMEDiation: FOCUS ON TRIPARTITE “META-ENZYMATIC” ACTIVITY

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Abstract

Soil pollution is a pressing problem requiring solutions that can be applied without large-scale side effects directly in the field. Phytoremediation is an effective strategy combining plant and root-associated microbiome to immobilize, degrade and adsorb pollutants from the soil. To improve phytoremediation, it is necessary to think of plants, fungi and bacteria not as individual entities, but as a meta-organism that reacts organically, synergistically and cooperatively to environmental stimuli. In this work, the potential of a microbial consortium along with a plant already known for its phytoremediation capabilities, *Schedonorus arundinaceus* (Scheb.) Dumort., was validated in a mesocosm experiment with pluricontaminated soil (heavy metals, PAHs and PCBs). Chemical analyses of the soil at the beginning and end of the experiment confirmed the reduction of the main pollutants. The microscopic observation and chemical analyses confirmed the greater root colonization and pollutant removal following the microbial treatment. To obtain a taxonomic and functional picture, tripartite (plant, fungi and bacteria) enzyme activity was assessed using a metatranscriptomic approach. The differential analysis of transcripts identified as enzymes showed that an increase in potential enzyme activity was observed in the rhizosphere after our biotechnological treatment. From a taxonomic perspective, an increase in the activity of some phyla, such as Actinobacteria and Basidiomycota was found in the treated sample compared to the control. An increased abundance of enzymes involved in rhizospheric activities and pollutant removal (such as dehydrogenase, urease, laccase etc.) was found in the treated sample compared to the control at the end of the experiment.

Keywords: *rhizosphere, metaorganism, phytoremediation, soil enzymatic activity, soil transcriptomics*

AERIAL DEPOSITION OF POLYETHYLENE MICROPLASTICS AFFECTS TOMATO (*SOLANUM LYCOPERSICUM* L.) RHIZOSPHERE SOIL ECOLOGY

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Abstract

In agroecosystems, a considerable amount of microplastics (MPs) reach the crop plants through aerial depositions. Here, we investigated the impact of MPs aerial depositions on the growth, root metabolome, and bacterial and fungal communities associated with the rhizosphere of tomato (*Solanum lycopersicum* L.). Tomato plants were treated with three concentrations (10, 100, and 1000 mg L⁻¹) of a solution composed of polyethylene microspheres (PE-MS) and distilled water. Control plants were supplemented only with distilled water. The leaves were sprayed with the solutions after 15 and 21 days of growth. After 31 days of growth, shoots, roots, and rhizosphere soils were collected. The plant material was used to measure shoot biomass, shoot water content, and root metabolomic profiling through high resolution gas-chromatography/mass-spectrometry. Rhizosphere microbial diversity was investigated via DNA metabarcoding of the bacterial 16S rRNA gene and fungal ITS2 region. Tomato shoots did not show differences in dry and fresh weight, but a significant reduction in water content was observed at 100 and 1000 mg L⁻¹. PE-MS aerial depositions increased the roots relative abundance of amino acids but also of carbohydrates and their conjugates. PE-MS significantly decreased the relative content of a pyrimidine derivative (5,6-Dihydrouracil), organic acids (lactic acid and tartaric acid), and fatty acids (palmitic acid and stearic acid). Further, microbial analysis revealed that PE-MS affected bacterial but not fungal beta-diversity. In conclusion, exposure of tomato leaves to PE-MS showed no effect on plant growth. Oppositely, PE-MS significantly altered the root metabolome and the bacterial diversity in the rhizosphere.

Keywords: *Microplastics, Rhizosphere, Microbial community, Plant, Metabolomics.*

FACTORS AFFECTING WATER EROSION OF SOIL IN NORTH KAZAKHSTAN: CONSTRAINTS AND SOLUTIONS

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Abstract

The traditional cropping system in semiarid regions of North Kazakhstan farming practices involves conservation mechanical subsoil tillage practices with summer fallow. The objectives of our study were: (i) to determine the effects of NT system, conventional subsoil tillage (CST) and summer fallowing practices on soil loss and soil-physical properties (ii) the effects of NT system and CST and topography factor on water and soil runoff (iii) to determine the effects of NT, CST and summer fallowing on precipitation use efficiency. Runoff of water and soil depends on landscape of the land use territory, exposition, land use management, water-physical properties of the soil in late fall (before winter frozen). The results of our field research and data analyses have shown that up to 60-70 percent of water from melting snow is lost from summer fallow prepared by conventional and up to 6,0-7,0 tons of soil from one hectare is eroded. In spring time the efficiency of water infiltration in summer fallow fields is about 13-20 percent as compared to 65-78 percent in stubble fields. Our research has demonstrated that No-till technology should be used in accordance to landscape and proper land use management. The system of dryland farming that deals with less soil tillage and more intensive soil cover crop rotations improves efficiency of moisture usage and reduces erosion stability.

Keywords: *water erosion, No-Till system, summer fallow, land use management*

APPLICABILITY OF HEC-HMS MODEL ON POORLY GAUGED CATCHMENTS: A CASE STUDY OF UPPER MARA RIVER BASIN, KENYA

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Abstract

The Mara River Basin (MRB) is one of the catchment of the Lake Victoria covering a drainage area of 13,750km² and form part of the Upper Nile Basin. It supplies water into the Lake Victoria throughout the year. In the recent years, the basin has undergone tremendous changes attributed to change in climate and long term monitoring. The aim of this study was to develop a framework of rainfall runoff model application in a poorly gauged basin by integrating with remote sensing, GIS and satellite derived dataset. Hydrological modelling is a necessary decision making tool for water resource and policy analysis. The study explored the potential of Hydrologic Engineering Centre-Hydrologic Modelling System (HEC-HMS 3.5) in conjunction HEC-GeoHMS extension in ArcMap 9.3 or ArcView as a tool for water management in upper catchment, Mara River Basin. HEC-HMS is a semi-distributed model which focuses on rainfall-runoff processes and simulation were applied on a daily scale. The model was calibrated and validated using the 2005 and 2006 data set respectively. The evaluation of the model was tested statistically employing the correlation coefficient (R^2) and Nash-Sutcliffe Efficiency Index (EI). The R^2 for Nyangores and Amala during calibration and (validation) were 0.53 (0.41) and 0.21 (0.24) respectively where else the EI during calibration and (validation) were 0.93 (0.91) and 17.10 (0.46) for Nyangores and Amala respectively. The model shows great potential in simulating the wet season runoff. The application of HEC-HMS model is considered to be satisfactory for Nyangores sub-catchment but further research is needed to assess the results of Amala sub-catchment.

Key words: *Hydrological modelling, HEC-HMS, GIS, MRB, Nash-sutcliffe, rainfall, runoff*

IMPROVING THE QUALITY OF ACCOUNTING INFORMATION THROUGH THE ORGANIZATION OF THE ACCOUNTING DEPARTMENT: AN EMPIRICAL STUDY IN THE MOROCCAN AGRICULTURAL CONTEXT

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Abstract

The objective of this paper is to highlight how the organization of the accounting department impacts the quality of accounting information of agricultural enterprises in the Souss-Massa region. In order to maintain harmony between the object of our research and the methodological path taken to understand it, we have developed a conceptual model composed of thirteen variables distributed over three levels stemming from the company's governance policies. Starting from a post-positivist paradigm that we have inscribed in a hypothetico-deductive reasoning, the passage from the theoretical base to the empirical side of the study was done through an investigation by structural modeling of third order with latent variables estimated according to the approach of repeated indicators following a type II model (reflective-formative). This model, which was tested on a sample of 213 observations, allowed to question the global hypothesis of the work, a conclusion all the more surprising, insofar as it opposes the results developed by Michalesco (1998) and Mahmoud (2012) according to which, one of the aspects supposed to influence the quality of accounting information is the internal characteristics of the accounting department of the company in the sense that the qualification of the accountant, the organization and the digitalization of the accounting department should promote the relevance of the accounting information

Key words: *Quality of accounting information; accounting department; agricultural firm; structural equation modeling.*

ATTEMPT TO MODEL THE IMPACT OF INTERNAL GOVERNANCE POLICIES ON THE QUALITY OF ACCOUNTING INFORMATION

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Abstract

The objective of this paper is to highlight the impact of the intensity of power relations on the quality of accounting information of agricultural enterprises in the Souss-Massa region. In order to maintain harmony between the object of our research and the methodological path taken to understand it, we have developed a conceptual model composed of thirteen variables distributed over three levels stemming from the governance policies of the firm. Starting from a post-positivist paradigm that we have inscribed in a hypothetico-deductive reasoning, the passage from the theoretical base to the empirical side of the study was done through an investigation by structural modeling of third order with latent variables estimated according to the approach of repeated indicators following a type II model (reflective-formative). This model, which was tested on a sample of 213 observations, revealed a very significant explanatory value of the company's governance policies on its accounting information quality. In this sense, the mode of remuneration of the manager, the separation of his functions (management/control) and the diffusion of the ownership of the company have monopolized all the merit to explain the impact of the intensity of the relations of power of a company on its quality of the accounting information.

Keywords: *Quality of accounting information, Intensity of power relations, Agricultural firm, Corporate governance policies, Structural equation modeling.*

EFFECT OF ARBUSCULAR MYCORRHIZAL FUNGI INOCULATION ON SORGHUM GROWTH SOWN IN PHOSPHATE SOLID SLUDGE SUBSTRATES

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Abstract

Despite the fact that it has been demonstrated that arbuscular mycorrhizal fungi can control the amount of phosphorus that is lost from soil, there is no complete quantitative analysis of how these fungi affect the loss of other soil nutrients on a global scale. The natural phosphate enrichment process generates sludge, which is generally stored in dikes. The large quantities of these discharges alter the environment and damage the natural development of fauna and flora. In this context and to look for solutions to this problem, this study was performed to assess arbuscular mycorrhizal fungi inoculation on sorghum growth sown in substrates based on phosphate solid sludge, whose objective is to recover sludge as an agricultural substrate. The experiment was conducted in a greenhouse. Two arbuscular mycorrhizal fungi (*Rhizophagus intraradices* and *Funneliformis mosseae*) were used as inoculum, as well. Solid phosphate sludge was amended with peat at rates (% v: v) of 0, 10, 20, 40, and 60, sown by sorghum, and inoculated by arbuscular mycorrhizal fungi. After two months from germination, the following parameters were evaluated in sorghum plants: morphological parameters, biomass, total nitrogen, total phosphorus, potassium, calcium, and root colonization. The results showed that all parameters were reduced with the increase in the concentration of solid sludge of phosphates. In comparison to the control, it has been found that sorghum plants that have been inoculated with arbuscular mycorrhizal fungi showed a statistically significant ($p \leq 0.05$) improvement.

Keywords: *phosphate solid sludge, arbuscular mycorrhizal, phosphorus, Biofertilizer.*

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BEE COLONY COLLAPSE SYNDROME IN MOROCCO

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Abstract

In Morocco, bee colony collapse disorder is described as a new phenomenon, recently appearing among some beekeepers. European and Asian authorities have been concerned for twenty years about bee colony collapse syndrome. Indeed, in Europe, America and Africa, this phenomenon has existed for many years. The combination of several climatic, environmental and health factors related to beekeeping practices is at the origin of this syndrome. The lack of rainfall, sufficient food or maintenance of hives are the reasons for the phenomenon of collapse and weakening of colonies. The total or partial collapse of hive colonies has compromised national honey production this year and next year. The disappearance of a large number of bees of all kinds also leads to an imbalance in agricultural yields. In this fact, an action plan has been implemented in order to reduce the negative effects of this phenomenon and an awareness program for the benefit of beekeepers on good beekeeping practices has been put in place. Practices such as strengthening the national surveillance and monitoring system for bee deaths and disappearances are encouraged and developed. The loss of bees can have serious consequences for biodiversity and humanity. Because wild and honey bees pollinate about a third of the plants we eat, thus contributing to an important ecological service. This communication aims to identify the causes and consequences of this phenomenon, to reflect on the main factors related to the colony collapse syndrome of bees in Morocco, and to identify the potential solutions to be implemented, in order to limit the impact of this event on the beekeeping sector.

Key words: *collapse syndrome of bee colonies, causes and consequences, impact, solutions*

VARIATION INDUCTION OF THE FRUIT QUALITY USING GAMMA IRRADIATION IN LEMON (*CITRUS LIMON* L.).

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Abstract

Lemon (*Citrus limon* (L.) Burm. (f)) is one of the main citrus species grown in the world after orange and tangerine. In recent years, consumption of lemons has increased rapidly in both the domestic and international markets due to the economic and human health benefits. This work is part of a program to improve and diversify the genetics of citrus fruits. Its objective is to study the variability of certain selection criteria related to fruit quality of variants derived from the gamma irradiation of buds of the Eureka lemon variety with a gamma radiation dose of 70 Gray. Statistical analyzes of the results of the three-year clonal evaluation from 2019 to 2022 showed significant differences between irradiated clones and the control variety (Citrons Eureka) for all variables studied (sugar content; number of seeds per fruit; the average weight of the fruit; percentage of juice; performance; polar and equatorial diameter; acidity level and maturity index). Two variants of G1M4 and G1M7 from irradiation were selected due to the limited number of seeds per fruit of up to 1 seed. Thus, gamma-ray irradiation allows the induction of genetic variability of certain criteria related to fruit quality, in addition to its positive effect on the reduction of the number of seeds per fruit. The irradiation of the bud opens up promising new prospects for the progress of the citrus sector in general and of the lemon trees in particular. Thus, today and in the near future, conventional methods of varietal improvement remain the basis of citrus varietal improvement programs.

Keywords: *Citrus; Limon; Irradiation; Fruit quality; Seedlessness.*

WATER AND SOIL CONSERVATION TECHNIQUES, FACING HUMAN CONSTRAINTS IN THE ATLANTIC PLATEAUS OF MOROCCO

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Abstract

Despite its location in the more favourable parts of Morocco, in terms of climatic conditions, the semi-arid plateaus in the Atlantic coastal zone of the Bouregreg watershed consists of marginal land with a high poverty and important indicators of degradation. But since the mechanisms that trigger the land degradation and the processes through which it unfolds are known and widely studied, the aspects relating to conservation are rarely subject to evaluation. There are, however, several measures, like assisted regeneration of cork oak in forest land, crop rotation in the rainfed agro-pastoral, ploughing along the contours which signify the will to restore soil fertility and reduce soil degradation. Nevertheless, the indicators of degradation are much more important than those of conservation. In our study area, the aspects of degradation are still important, despite the high potential for sustainable land management, because the human constraints face a sustainable management and prevent its realization. That is why we try in this paper to contribute and highlight the most promising techniques and practices in terms of improvement of the surface state, allowing regulating the hydrological functioning, the increase of the yields, the fodder potentialities and the conservation of biodiversity. A multidisciplinary methodology has been used by our team in order to allow for an evaluation of agro-silvopastoral techniques and approaches applied by different actors. The goal is to reach an optimal expansion of farming best practices especially with lands most vulnerable to desertification, which would lead to a better management of the natural resource heritage.

Key Words: *Land degradation, assessment, water and soil techniques, management, Morocco.*

ANALYSIS OF HEAVY METALS IN MUSHROOM AND NUTRIENTS IN VERMICOMPOST PRODUCED USING WATER HYACINTH

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Abstract

In Nepal, lakes of Pokhara especially Phewa, Begnas and Rupa are highly affected by Water Hyacinth (*Eichornia crassipes*) invasion. Water Hyacinth (WH) contains nutrients such as nitrogen (N), Phosphorus (P) and Potassium (K) that makes it useful as organic inputs to soil. The purpose of this experimentally designed study is to assess the suitability of WH for mushroom and vermicompost production. For mushroom production, five treatments were prepared: controlled Rice Straw (RS), 1:1 (WH: RS), 1:2 (WH: RS), 2:1 (WH: RS), and controlled Water Hyacinth. Vermicompost was produced by reusing the same Water hyacinth bio-product that was used to grow mushrooms. Heavy metal concentrations in mushrooms were determined using the AOAC method. Controlled Water hyacinth, 1:2, and 2:1 in terms of heavy metal presence were found appropriate and safe for mushroom production among five prepared treatments. The highest average N level was found in vermicompost of 1:2 sample ratio i.e. 1.870%, P level in rice straw i.e.0.279% and K level in water hyacinth only i.e. 0.055%. Rice straw, which is commonly used in mushroom farming, is not available all year whereas water hyacinth is abundant and free of cost. This result suggested that the whole process layouts the option for sustainable management of WH as well as an alternative substrate of rice straw for mushroom farming. The process also reduces WH bio-product waste by reusing it for vermicomposting. Produced vermicompost can then be used in agriculture sectors where farmers are already struggling due to high fertilizer prices and a lack of compost fertilizer.

Keywords: *Water hyacinth, Nutrients, Mushroom, Vermicompost*

STUDY OF SOILS POLLUTED BY MTEs IN THE GOUNTI YENA VALLEY (NIAMEY) WITH A VIEW TO SETTING UP A PHYTOREMEDIATION TEST

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Abstract

The valley of Gounti Yena is an area of strong market gardening activity. However, this valley is surrounded by multiple sources of pollution that contaminate soils. However, very little data is available on soil contamination by MTEs in NIGER. Thus, in the interest of consumer safety and ensuring a healthy environment for the population, a study on soil pollution by the MTEs in the Gounti Yena Valley was initiated. The objective is to contribute to new data on soil pollution on the one hand and on the other hand to remedy this pollution through a biological technique: phytoremediation. The results showed that standards were exceeded, particularly in Cu (369,42 mg/kg), Pb (725,66 mg/kg) and Zn (5 546,30 mg/kg). For example, the Zn contents were up to 18 times higher than the AFNOR NF U 44-041 standard. The study of transfer of these MTEs from soils to amaranth, sorrel, okra and tomato revealed a transfer of soil MTEs to these plants. To evaluate the possibility of setting up a phytoremediation technique, hyperaccumulative plant species were sought. For this purpose, 59 species of herbaceous and 24 species of ligneous were inventoried. Thanks to the literature, 14 plant species turn out to be hyperaccumulative. *Datura innoxia*, *Cyperus esculentus*, *Ricinus communis* were selected. This phytoremediation carried out has shown that these plant species have the capacity to reduce 44.27% for *Cyperus esculentus*, 41% for *Datura innoxia*, for 136% for *Ricinus communis* the initial concentration of Zn in soils in one month of culture. These plant species are very good at phytoremediation of the soils of the Gounti Yena valley and could well clean up other soils polluted by the MTEs.

Key words: MTEs, soils, phytoremediation, Niger.

CHARACTERISATION AND INSECTICIDAL ACTIVITIES OF *PETIVERIA ALLIACEA* SILVER NANOPARTICLES SYNTHESISED EXTRACTS ON COCKROACHES

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Abstract

Protection of the environment through the use of environmentally friendly approach should be incorporated into the management of household insect pests especially cockroach. This experiment was conducted with a view to study the effects of *Petiveria alliacea* silver nanoparticle (AgNPs) biosynthesized extract against major household insect pests (cockroach). Silver nitrate (AgNPs) was characterized using UV spectrophotometer and Fourier transform infrared (FTIR) spectroscopy analysis was done. The two major plant parts of *Petiveria alliacea* (leaf and roots) were tested at three different concentrations (1, 5, 10 v/v) using two mode of application (fumigant toxicity and contact toxicity) at different hours of exposure. The peak absorbance occurred at the wavelengths of 426.32 and 442.11 nm for Nano *P. alliacea* leaf and Nano *P. alliacea* root respectively. The effectiveness of the applied nanoinsecticides depend on the concentration, hours of exposure, mode of application and plant parts. Application of the insecticide through fumigant killed faster than contact. For instance, 80-90% mortality was observed through fumigant while 40-50% mortality was recorded after three hours of exposure applied at 10% v/v. However, nanoparticle synthesized *P. alliacea* extract exhibited insecticidal action. Therefore, Nano based insecticides can be incorporated into the pest management program of household pests especially cockroach.

Keywords: *Cockroach, Petiveria alliacea, Silver nanoparticle, UV spectrophotometer, Fourier Transform Infrared.*

ROLE OF COMMUNITY ENGAGEMENT AND CIVIC EDUCATION IN ENVIRONMENTAL PROTECTION AND NATURAL RESOURCES MANAGEMENT IN AFRICA

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Abstract

Environmental sustainability has become a prominent global issue as many groups are working hard to develop plans on use and preservation of natural resources. As universities prepare students through civic education courses and training to address critical issues in a complex society, pedagogy and curriculum development have been broadened to include thoughtful responses to environmental issues. Through interdisciplinary, community-based education, students gain an awareness of and learn to make an investment in sustainable communities. Likewise, community members, creators of knowledge, and educators of current and future citizens and practitioners play a significant role in establishing sustainable environments through environmental protection programs and policy implementation. The need to identify the underlying structural causes of environmental and natural resources degradation and the willingness to develop the right competence to address critical and active engagements are of utmost importance. This study therefore investigates the role of communities and citizens in the attainment of sustainable environments and natural resources for all. An online survey and on-site survey of selected communities (Bwasa and Bakingili in the Mount Cameroon National Park (MCNP)-Cameroon, Opara and Onigambari Forest Reserve, Oyo-Nigeria) in Africa were carried out to assess the knowledge and relative importance of community engagement and civic education (CECE); attitudes towards CECE; impacts of behaviors regarding teamwork in nature management; as well as barriers and willingness to behavioral change (acceptance and commitment). It was concluded that CECE empowers the host communities to participate in addressing its own needs and disparities while ensuring that community priorities are well understood.

Keywords: *Africa, Community engagement, Civic education, Environmental protection, Natural resources management.*

INFLUENCE OF ZN NUTRITION ON THE PRODUCTIVITY, GRAIN QUALITY AND GRAIN BIOFORTIFICATION OF WHEAT UNDER CONVENTIONAL AND CONSERVATION RICE–WHEAT CROPPING SYSTEMS

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Abstract

This study was conducted to evaluate influence of zinc (Zn) application on productivity, grain biofortification and grain quality of wheat planted under plough tillage (PT) and zero tillage (ZT) systems. Zn was delivered as soil application (10 kg ha⁻¹), foliage spray (0.025 M) and seed priming (0.5 M) in wheat planted under PT and ZT systems. ZT had higher total soil porosity, total soil organic matter, soil organic carbon and soil microbial biomass carbon than PT. Zn application, by either method, improved grain yield, grain Zn and grain quality in both tillage systems. The grain Zn concentration was 72% and 59% higher with soil-applied Zn in ZT wheat during 2016–2017 and 2017–2018, respectively, compared with no Zn. However, Zn seed priming was the most effective in improving wheat grain yield in both tillage systems. Foliage and Zn soil application were better in improving the indices of Zn use efficiency of Zn. In conclusion, Zn seed priming was the most effective method in improving the wheat grain yield, whereas soil Zn application in ZT and foliar applications in PT were the most effective for grain Zn biofortification. However, Zn soil application was the most cost-effective method of Zn application.

Keywords: *Economics; grain biofortification; grain quality; conservation agriculture; seed priming; soil health*

REMOVAL OF THE WATER FROM FENAMIPHOS PESTICIDE IN THE SOIL USING MORINGA OLEIFERA

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Abstract

The development of a sorbent low cost-effective to improve the removal of Organophosphate pesticides from contaminated water solutions continues to inspire. In the present display study, different sorbents such as *Moringa oleifera* (FENAMIPHOS) were studied. Effect of temperatures (10 to 40 °C) affecting the adsorption process, such as concentration of FENAMIPHOS (2 to 30 ppm), sorbent dose (0.05 to 0.4)g, solution pH (2 to 11), exposure time (10 to 80) Minutes. The adsorption of FENAMIPHOS sorbents follows the Freundlich model is more suitable than the Langmuir model. Maximum absorption capacities of FENAMIPHOS about 49 mg/g were found. *M.oleifera* removal was achieved at pH 7 at initial concentrations of FENAMIPHOS 20ppm in a contact 30 minutes period. The kinetic data fit well with the energy functions and linear models. Thermodynamic parameters reveal the spontaneous and endothermic nature of the FENAMIPHOS adsorption process. Sorbents can be introduced as an efficient and inexpensive alternative for removing FENAMIPHOS-contaminated water. Removal of (FENAMIPHOS) from contaminated water solution.

Keywords: *water, environmental health, pollution, pesticides, Gaza*

PURIFICATION OF WATER FROM CHLORPYRIFOS IN THE SOIL BY USING MORINGA OLEIFERA

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Abstract

The development of cost-effective sorbents to improve the removal of pesticides from contaminated water solutions continues to inspire. In this study, different sorbents such as Moringa oleifera. Chlorpyrifos (CPF). was studied for the first time. Effect of temperatures (10-40 °C) affecting the adsorption process, such as concentration of CPF (2-30 ppm), sorbent dose (0.05-0.4)g, solution pH (2-11), exposure time (10-80) Minutes. The adsorption of CPF sorbents follows the Freundlich model is more suitable than the Langmuir model. Maximum absorption capacities of F Chlorpyrifos 53 mg/g were found. , Moringa oleifera removal was achieved at pH 7 at initial concentrations of CPF 20ppm in a contact 30 minutes period. The kinetic data fit well with the energy functions and linear models. Thermodynamic parameters reveal the spontaneous and endothermic nature of the CPF adsorption process. Sorbents can be introduced as an efficient and inexpensive alternative for removing CPF-contaminated water (ΔS_0) and standard free energy (ΔG_0). The adsorption was carried out by an endothermic process because the obtained (ΔH_0) values for removal were less than 40 KJ/mol. Negative value Standard free energy values (ΔG_0) indicate that the adsorption process is irreversible. Removal of (CPF) from contaminated water solution.

Keywords: *wastewater , Environmental health , pollution, pesticides, , PALESTINE*

REMOVAL OF NITRATES FROM DRINKING WATER USING CHIA SEEDS IN GAZA STRIP, PALESTINE

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Abstract

In almost all parts of the world, ground water pollution is a growing concern. The importance of removing pollutants especially hazardous cationic heavy metals and anions is increasing because of growing water demands in semi-arid areas all over the world. Pollution is therefore one of the most serious problems affecting our reality and expresses its seriousness in more than one area in the aspects of community life. Human resource nitrate levels in groundwater kept on rise. The most cause of such levels of nitrate is the seriously utilize of fertilizers and pesticides as well as the filtration of wastewater into the aquifer.

Keywords: *Nitrate, Chia seeds, Drinking water, Gaza Strip.*

CHEMICAL AND ENERGETICAL PROPERTIES OF CORN STOVER FRACTIONS

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Abstract

The development of used biomass resources is a promising way to solve the problem of energy shortages and environmental pollution which has attracted worldwide attention. In addition, the biofuels produced are considered carbon-neutral due to zero accumulation of greenhouse gas emissions and lower sulfur dioxide emissions, as is the case when burning coal or other fossil fuels. Biomass biological fermentation is the main method to extraction of biomethane. Biomethane is a new frontier of the biogas chain. It can replace traditional natural gas and therefore it can be used as a fuel of fed in to the network. Corn is one of the top crop materials with a wide spectrum of uses, including those for non-food purposes. Therefore, a good source of biomass can be corn stover - residues after corn grain harvest. Unfortunately, corn stover is a very difficult material to decompose during the methane fermentation process. Despite this, corn stover is lignocellulose biomass and is not compatible with food production. The corn stover makes of 47-50% of total corn yield. The corn stover is a morphologically and chemical diversified biomass and contains the stalks, leaves, husk and cob cores in ratio 15:22:14:50 per kg of dry matter of corn grain. For this reason the aim of the studies was exploration of chemical and energetical properties of corn stover fraction. The research program included the elemental analyses and methane yield test of corn stover fraction two corn varieties. The results illustrate the energy potential contained in corn straw.

Keywords: *Lignocellulose biomass, Corn stover, Methane potential, Methane fermentation.*

MICROBIAL COMPOSITION AND ENZYMATIC ACTIVITY IN ARABLE SOIL PROFILES

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Abstract

In agriculturally used soils, studies on microbial diversity and enzymatic activity are usually conducted in the upper layer of the soil profile. In contrast, microbial properties in the deeper genetic horizons of the soil profile are understudied. The enzymatic and microbiological characteristics of the soil in the deeper layers of the profile depend, e.g., on the soil type and the size and distribution of the plant root system. The study aimed to compare microbiological properties of Luvisol soil under winter wheat and alfalfa and to evaluate the effect of two soil types (Luvisol and Phaeozem) under the same crop (alfalfa) on the examined properties. Essential physicochemical properties, the activity of selected enzymes of C, N, and P metabolism, and selected microbial groups (total bacteria, copiotrophs, oligotrophs, actinomycetes, and filamentous fungi) were tested in five genetic horizons of 3 soil profiles. The enzymatic activity of the majority of studied enzymes (dehydrogenases, catalase, phenoloxidase, peroxidase) and microorganism groups was highest in the surface horizon (Ap) and significantly decreased with the depth of the soil profile. However, the activity of some enzymes was similar in all genetic horizons (e.g. α -glucosidase) or the subsurface and deeper horizon (e.g. acid phosphatase). A significantly higher abundance of microorganisms and activity of enzymes were found in Phaeozem than in Luvisol. The most significant differences in soil microbiome composition were observed between Bt and G1 and C and G2 horizons. On the other hand, a distinct correlation between the activity of the studied enzymes and the cultivated plant's root system size was observed exclusively at the surface level of the studied profiles.

Keywords: *Soil microorganisms, Enzymatic activity, Soil profiles*

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FERTILISATION POTENTIAL OF DIGESTATE OBTAINED FROM *ZOPHOBAS MORIO* FRASS

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Abstract

Nowadays, considering the exhaustibility condition of energy carriers, renewable and non-renewable energy sources are taken into account. The first group includes fossil fuels: fissile and conventional, which include crude oil, natural gas, peat, thorium, uranium, and coal. The second group comprises rapidly regenerating resources, the amount of which does not end up due to exploitation. This group includes the energy of water, sun, or biomass from which high-calorific biogas is obtained. Biomass consists of agricultural raw materials, agricultural by-products, and animal waste. After undergoing the anaerobic decomposition of organic matter, these products constitute the digestate, hereinafter referred to as the digestate. During the anaerobic decomposition of organic matter, plant components such as nitrogen and phosphorus are mineralised, nitrogen to NH_4^+ and phosphorus to PO_4^{3-} . In these forms, they are much more digestible for plants. One of the alternative methods of obtaining digestate is, among other things, the use of insect frass. One of the insects is *Zophobas morio*, commonly known as superworms, but also due to its body rich in protein and fats, bred and used in feeding fish, reptiles, and birds. The study aimed to obtain a digestate from the excrement of the Tenebrionidae beetle – superworm (*Zophobas morio*) and determine its fertilisation possibilities. The digestate from the frass of *Z. morio* has a moderate nitrogen concentration (<0.2%), but it is in the form of ammoniacal nitrogen, easily absorbed by plants. In addition, over 90% of the solid fraction of the digestate is carbon, which improves the properties and structure of the soil. The soil fertilised with digestate containing lignocellulose and easily decomposable carbohydrate fractions has better air-water properties and more significant microbiological activity. The digestate obtained from *Z. morio* frass can be used to fertilise, e.g. energy plants following the Zero-Waste Circular Economy.

Keywords: *Superworm, Frass, Digestate, Fertilisation*

MECHANICAL PROPERTIES OF CORN COBS CORES

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Abstract

Environmental protection and reduction of fossil fuels are contribute to the search and development new environmentally friendly materials. Low cost, renewable increase and possible of recycling make agriculture biomass can be source of natural fibrous materials. As a representative source of agriculture biomass is considered corn stover, because account 29% of worldwide tonnage of fibrous materials from field crop. In last decade the worldwide corn grain production increase of 39%. This increases the resource base corn stover to biomaterials production. Corn stover consists of five factions: cobs cores, husks, leaves and stalks. There are technologies solutions with enable separated collection of corn stover fraction. Makes is possible separately used the fraction for build biomaterials production. However, the first thing to do is to recognize the physical and mechanical properties of the raw material. Therefore the aim of the studies was search mechanical properties of corn cobs cores. The research program included comparison of destructive force cobs cores of two varieties in to state - fresh after the harvest and dried. The results indicate that the state and corn varieties have a significant impact of the mechanical properties of cobs cores. The dried cobs cores characterizing the greater destructive force.

Keywords: *Corn cobs cores, Mechanical properties, Build biomaterials*

A NEW BIOINDICATOR OF AN EXTREMELY FERTILE AQUATIC ENVIRONMENT IN THE AREA OF INTENSIVE LIVESTOCK PRODUCTION IN POLAND

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Abstract

In recent years, there has been a very strong industrialization of agriculture in the world, which has its environmental consequences. The aim of this study is to assess the status of waters around industrial animal farms where the appearance of *Haematococcus pluvialis*, a new one for Poland, was observed. Originally it is found in the waters of the Northern Hemisphere and along the European Atlantic coast. The research covered two sites in northern and western Poland (W – N51°51'27.63", E17°22'26.24"; G – N53°15'41.25", E17°55'11.86"). The scope of the research included the analysis of surface water, rainfall and groundwater around the pig farm (G) as well as American mink and chicken broiler farms (W). In both cases, blood-red or green precipitation was recorded in the vicinity of the farms. Surface waters (watercourses and the pond) also turned red, which was caused by the presence of *Haematococcus pluvialis*. Among the investigated precipitation parameters, the maximum concentrations of nitrates and total nitrogen exceeded the background respectively 133 and 14 times. Maximum groundwater concentrations reached 15.8 mg PO₄/L, 17.4 mg P/L, 38.0 mg N-NO₃/L, 76.6 mg N-NO₃/L. In the tested surface waters, the norms were exceeded for maximum values at the level of 455 times for phosphates, 149 times for total phosphorus, 175 times for ammonium nitrogen and 96 times for total nitrogen in relation to good status, in accordance with the European Union Water Framework Directive. The aquatic environment in the studied regions where was observed *Haematococcus pluvialis* can be classified as hyper-contaminated.

Keywords: *Haematococcus pluvialis*, bioindicator, intensive livestock farms, water quality, point-source pollution.

MULTIFACETED APPLICATION OF SUPERWORM (*ZOPHOBAS MORIO* F.) IN THE ZERO-WASTE CIRCULAR ECONOMY APPROACH

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Abstract

Insects are the most abundant group of animals in the world. About 1 million species have already been recorded in this group, and this number increases by several hundred new items every year. They perform many functions that can positively affect the surrounding environment. One of the most exciting families is Tenebrionidae, numbering about 20,000 species (Nabozhenko, 2019), of which 86 species live in Poland (Iwan et al., 2010). Many species are found in the natural environment, specifically in rotting wood and litter. One of the species, found in decaying wood is the superworm (*Zophobas morio* F.). *Zophobas morio* reaches 3-4 cm in length. The adult insect has a massive, elongated, black, slightly dull body. Larvae are light cream, with brown around the head and on the border of the segments. They have three pairs of short legs and almost invisible antennae. The paper presents preliminary studies involving superworm larvae, demonstrating the possibility of its comprehensive use in the surrounding environment. Due to their high protein content, superworm can be used as food for humans and animals. Post-cultivation residues (frass) can be composted and then used as fertilizer. The digested residues can also be used to produce ethanol. Obtained digestate can be used to fertilize trees such as poplar and pine. The superworm, like the mealworm, can also digest difficult-to-digest waste such as plastics. Although Superworm is a wood pest, this insect has a wide range of applications in science and economy.

Keywords: *insects, Zophobas morio, fertilization, protein source, ethanol.*

EVALUATION OF THUNBERG'S BARBERRY TOLERANCE TO AIR POLLUTION IN URBAN CONDITIONS

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Abstract

Due to the significant deterioration of air quality in recent years, urban vegetation is increasingly exposed to the harmful effects of various pollutants that can interfere with many physiological processes and cause changes in plant morphology. It is the means of transport that mainly emit many dangerous compounds, including heavy metals, nitrogen oxides, and particulate matter. The research includes issues concerning tolerance mechanisms of Thunberg's barberry shrubs to air pollution. The study was conducted on plants growing close to public transport in the Polish city (Poznań) at the end of the growing season. The accumulation of micro-dust impurities on leaf blades was measured. It turned out that the shrubs effectively kept the dust between the hairs. The epicuticular wax layer enhanced their deposition. The response of plants to air pollutants was assessed by the air pollution tolerance index (APTI), described by cell sap pH, total chlorophyll content, ascorbic acid content, and relative water content. This index's value determines plants' tolerance to pollutants because individual biochemical and physiological parameters determine the plant's adaptation to the environment and thus determine the sensitivity or resistance of a given species to environmental stress factors. Based on the obtained results, the tested shrubs can certainly be recommended for urban plantings to reduce air pollution.

Keywords: *Barberry shrubs, Micro-dust impurities, Air pollution tolerance index (APTI)*

BIOFILM – MULTICELLULAR ORGANISMS COMMUNITY

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Abstract

Bacteria can grow as planktonic (free-living) cells or 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. Investigations of bacterial communities and characterization of mineralogy of the environment in the Złoty Stok As-Au deposit were carried out. The analysis revealed the presence of picroparmacolite as the most common secondary arsenic mineral in the mine. Total DNA was extracted from slime streams or slime biofilms samples to investigate the bacterial communities. PCR amplification of 16S rDNA was performed followed by subcloning of its products. Over 170 clones were analyzed by the RFLP method. Eight group of clones representing different restriction patterns were identified. The nucleotide sequences of their inserts suggest that bacteria present in the mine environment belong to: *Flavobacteria*, *Sphingobacteriia*, *Bacteroides*, *Proteobacteria*, *Mollicutes* and *Firmicutes*. The metagenomic approach allows to demonstrate a higher diversity of microbiota than classical microbiological studies of cultivable isolates.

Keywords: *bacteria, biofilm, mine, metagenomic, environment.*

BIOACTIVE COMPOUNDS OF SPONTANEOUS HOP AND HOP IN CULTIVARS IN THE NORTHEAST OF PORTUGAL

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Abstract

Hop, whose scientific name is *Humulus lupulus* L., is a species of the family Cannabaceae, with climbing, perennial and dioecious characteristics of great importance due to its compounds of interest such as polyphenols and acids. The female inflorescences have glands that secrete mainly lupulin. Hop is known worldwide as an essential raw material and flavoring agent in beer production. Phytochemical compounds from the plant such as xanthohumol, humulone and lupulone have also been used in cosmetics. Moreover, the plant has beneficial properties -anti-inflammatory, antimicrobial, antioxidant. The area of Bragança (Trás-os-Montes) is rich in spontaneous hop and cultivars. The samples of spontaneous hop were collected in different areas of the Bragança district and were analyzed and compared to the varieties of cultivars (Nugget, Polaris, Cascade, Centennial and Chinook). The volatiles extracted from the female cones, in a LikensNickerson system, were analyzed by GC and GC-MS. The α - and β -acids, from where extracted with calibration standard ICE-3 and analyzed by HPLC. Characterization of α - and β -acids, and of the phenolic profile of the Hop samples, was also performed by UHPLC-DAD-ESI-MSⁿ. The cultivars and their respective spontaneous varieties showed similarities in the monoterpenic component, with β -myrcene as the main compound. Regarding HPLC analyses, cultivars showed total values about 15% of α -acids and about 4% of β -acids, while the spontaneous variety showed 7% of α -acids and 9% of β -acids, corresponding to the compounds cohumulona, humulone, colupulona, lupulona and xanthohumol. Quercetin and kaempferol glycosides were also present in some extracts as minor compounds.

Keywords: *Hop, bioactive compounds, chemistry, α -acids and β -acids, phenolic compounds.*

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ASPECTS REGARDING THE IMPACT OF POLLUTION ON THE HEALTH OF THE INHABITANTS OF WESTERN REGION, ROMANIA

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Abstract

This paper aims to present the main aspects related to the current state of the environment in the Western Region, as well as the impact on the environmental components, in order to ensure a harmonious economic development and sustainable use of natural capital. Industrial activities located in this delimited area, sometimes very close or even in human settlements, lead to the appearance of intense sources of environmental pollution with effects on the health of the inhabitants. The short- and medium-term effects of air pollution are detrimental to human health and harm ecosystems and the economy. Long-term pollution affects the environment through: the effect of greenhouse gases, the destruction of the ozone layer, acid rain, the presence of micropollutants, heavy metals, dust and suspended particles. The greenhouse gases specified in one of the annexes to the Kyoto Protocol are: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), perfluorocarbons (PFCs), hydrofluorocarbons (HFCs) and hexafluoride sulfur (SF₆). Heavy metals are now far ahead of such well-known pollutants as carbon dioxide and sulfur, and are forecast to be considered more hazardous than nuclear and solid waste. Heavy metal contamination is associated with their widespread use in industrial production, coupled with poor cleaning systems as a result of which heavy metals enter the environment. Soil is the main medium in which heavy metals enter, even those in the atmosphere and aquatic environment. According to N. Reimers' classification, metals with a density greater than 8 g / cm³ should be considered heavy.

Key words: *Western Region, pollution, heavy metals, suspended dust, gas emissions*

AGROECOLOGICAL ASSESSMENT OF CHERNOZEMS PEDODIVERSITY TO REDUCE ECO RISKS OF AGRI-TECHNOLOGIES USING IoT BASED DSS

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Abstract

The Chernozems are characterized by potentially high fertility, but the efficiency of their use is often limited by the increased spatial variability of topsoil properties and high dynamics of agroclimatic conditions. Environmental and economic risks of agriculture could be significantly reduced when using agroecological smart DSS with operational adjustment of applied agricultural technologies according to data from IoT monitoring system. The effectiveness of DSS is largely determined by the rational choice and placement of the IoT monitoring "points". The paper presents the detailed pedodiversity of representative land plots with durum wheat in conditions of four oblasts in the Volga region in the abnormally arid growing seasons of 2018 and 2021. Soil significant spatial variability limits the effectiveness of fertilizing. There is a significant spatial heterogeneity in pH (H₂O) both between the different plots and within each of them. Significant difference is between the average pH in the Samara and Saratov sites (6.41 and 7.87, respectively). The most significant within-field differences are noted for topsoil in the Orenburg site (pH varies from 6.30 to 8.23). A comparative analysis of soil manganese availability showed that the Chernozems in this site have the lowest content of mobile manganese (13.6 mg/kg), but the highest value of acid-soluble Mn (505 mg/kg). So, in conditions of high temperatures and lack of soil moisture, mobile Mn becomes an agroecological factor limiting the durum wheat yield, which requires adjustment, but with minimally necessary and sufficient doses of micronutrient – to avoid environmental problems in subsequent seasons with increased precipitation.

Keywords: *Farming environmental risks, IoT based DSS, Durum wheat, Agricultural technologies, Chernozem pedodiversity*

APPLICATION OF UNMALTED TRITICALE IN BREWING

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Abstract

Malted barley is the main raw material in the traditional brewing. Due to the complex nature of the malting process, which is also energy intensive and uses large volumes of water, the use of unmalted cereals in brewing process is being accelerated, leading to the creation of unique beers. It is important to consider that unmalted cereals mainly have amylolytic enzyme deficit, which requires the addition of commercial enzymes during the brewing process. However, a cereal like triticale is an exception. Triticale has a low gelatinization temperature and high enzymatic activity, which indicates its capability of degrading its own starch with efficiencies equal to those of barley malt, but the usage of triticale increases the presence of β -glucans and arabinoxylans in the mash, which could lead to a slower beer filtration. The aim of this study was to evaluate the possibility of triticale application as partial substitute for barley malt in beer production. Triticale variety NS Paun was used in a different proportions in beer production with or without addition of commercial enzyme for wort viscosity reduction - Shearzyme. Regarding extract content triticale variety NS Paun could be used as the substitute for barley malt up to 70%. However, with an increase in triticale content in the grist, viscosity increased, which was corrected with the addition of commercial enzyme. The highest ethanol content was obtained for beer produced with the 10% of triticale in the grist (2.78%), without enzyme addition. The obtained results indicate that triticale could be used as a partial substitute for barley malt.

Keywords: *Triticale, malt, wort, beer.*

ESSENTIAL OIL OF FENNEL IN SUPPRESSION OF *Botrytis cinerea* Pers. Fr.

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Abstract

Phytopathogenic fungi have been known to cause disease for a long time. They cause about 75% of plant diseases. Phytopathogenic fungi are eukaryotic organisms which body is mostly conical in shape. Therefore, they can penetrate the body in three ways: through the natural openings of the plant, through the resulting mechanical tissue injuries, as well as by direct penetration through uninjured tissue. *Botrytis cinerea* Pers. Fr. is one of the pathogens causing significant losses in more than 200 crops worldwide. The objective of this paper was to determine the effect of the fennel essential oil against the growth of *Botrytis cinerea* Pers. Fr. by measurement of inhibition zones. Mycelia of *Botrytis cinerea* Pers. Fr. were placed on PDA (potato dextrose agar). Four sterile discs (8 mm) were impregnated with 5, 10, and 15 µl of fennel essential oil. In control, distilled water was used for the impregnation of discs. All experiments were performed in triplicate. Incubation was done at 22°C for six days in the dark. The obtained results showed that increasing the essential oil volume had a strong influence on inhibition zone diameter. Using 5, 10 and 15 µl of fennel essential oil, inhibition zone diameter was 2.5, 5.0, and 5.5 mm, respectively. In the control variant, the inhibition zone was not detected. This research confirms the potential for the application of fennel essential oil in the suppression of *Botrytis cinerea* Pers. Fr. growth.

Key words: *fennel, essential oil, Botrytis cinerea.*

ANTIFUNGAL ACTIVITY OF SODIUM BICARBONATE AND GARLIC AQUEOUS EXTRACT

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Abstract

Current trends in phytomedicine are ordering the use of ecologically accepted methods for plant protection. That can be implemented by reducing the usage of the standard chemical resources and by applying the newest methods of biological measures. Moreover, the preventive use of preparations allowed in organic production can successfully prevent the growth of the phytopathogenic species of fungi. The objective of this work was the examination of the antifungal effect of sodium bicarbonate and garlic aqueous extract. Mycelia of two phytopathogenic fungi (*Fusarium oxysporum* and *Plasmopara viticola*) were placed on potato dextrose agar. The sterile discs were impregnated with 10 µl of self-made preparations from sodium bicarbonate (0.5%, w/v) and garlic aqueous extract (0.4%, w/v). All experiments were performed in triplicate. The measurement of inhibition zones was performed after six days of incubation (at 22 and 30° C). In the control variant, distilled water was used for the impregnation of discs. The results showed that all preparations affected the growth of phytopathogenic fungi. By incubation at both temperatures, a higher inhibition rate of *Fusarium oxysporum* growth using garlic extract compared to sodium bicarbonate was observed. By incubation at 22°C, a more expressed inhibition rate of *Plasmopara viticola* using garlic extract compared to sodium bicarbonate was observed. In contrast, sodium bicarbonate was the more efficient agent on the inhibition rate of *Plasmopara viticola* at 30°C compared with garlic extract. This research indicates that garlic extract and sodium bicarbonate may have a potential for application against *Fusarium oxysporum* and *Plasmopara viticola*.

Key words: sodium bicarbonate, garlic extract, *Fusarium oxysporum*, *Plasmopara viticola*.

MEASUREMENT OF ELECTRICAL CONDUCTIVITY OF SOIL AS A BASIS FOR SUSTAINABLE SOIL MANAGEMENT APPROACH ON EXPERIMENTAL FIELD

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Abstract

We first see the differences in the field when we notice the differences in the crop. After harvest yield showed differences too. Let's start with the assumption that the soil in the field is different. The simplest and fastest way is to measure the values of soil EC. We determine the ratio of sand, silt and clay. We did a scan and we got a soil map. By grouping the obtained EC values we get the zones within which we perform sampling. In this way we no longer have to move zigzag or diagonally or place a net on the field from which we plan to take one or more samples. Based on the results from laboratory, we choose the formulation of mineral fertilizer and the amount. Maybe we will need a VAT (variable rate technology) spreader and maybe not? First plot of 11.5 hectares was scanned, mapped and sampled. With the obtained analyzes of soil fertility parameters we strive to keep our varieties and hybrids in the same conditions of nutrient. The differences in the soil texture serve to adjust the operations in the basic tillage and preparation of the soil for sowing as well as in the sowing itself if it is need. Since 2016, we have been gradually making maps of our Experimental Field, which consists of 270 hectares of major arable crops and two hectares of orchards – apple and nectarine. We start from the soil by introducing sustainable land management approaches.

Keywords: *soil EC, map, zone, VAT, sustainable*

AMBIGUITY IN THE RESULTS OF USLE K-FACTOR OBTAINED BY NOMOGRAPH AND ERODIBILITY EQUATION

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Abstract

Universal Soil Loss Equation (USLE) is the most applied model for soil erosion assessment. It takes into consideration five soil erosion factors among which soil erodibility factor (K) is a measure of inherent resistance of soils to erosion. In the formulation of USLE model, K-factor was determined experimentally, and then the authors created USLE nomograph to facilitate the work, and in the next step, created the equation for faster K-factor determination. This paper aims to compare K-factor obtained by USLE nomograph and USLE equation. A total number of 108 soil samples have been collected in Western Serbia. For the determination of K-values, particle size distribution and soil organic matter were analyzed in the laboratory, whereas soil permeability and soil structure were assessed according to the USLE document procedure. The results have been compared using basic statistics. The average K-values obtained by nomograph and equation differ for almost 15%. There is statistically significant correlation between the two methods, but coefficient of determination amounts to 0.5802, which indicates pretty high deviation. Root Mean Square Error (RMSE) amounts to 0.008, which is quite high, whereas index of agreement amounts to 0.93, representing good agreement. These results are ambiguous. We think that 15% of absolute error is a threshold value between single samples, which occur in only 56% of the cases. Therefore, the obtained results indicate the gaps in the determination of K-factor and could contribute to further improvement of soil erodibility determination and consequently, soil erosion assessment.

Keywords: *Soil erodibility, USLE, soil erosion*

POTENTIAL BIOTECHNOLOGICAL UTILIZATION OF EFFLUENTS FROM OLIVE OIL PRODUCTION

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Abstract

Olive oil production represents an agro-industrial activity of vital economic importance with a long tradition of application. Although this manufacturing process is considered as simple and environmentally friendly technology, during the olive trees cultivation and olive processing into oil the significant amounts of solid and liquid effluents are generated, among which the most dominant are olive leaves and pomace, as well as olive oil mill wastewaters. Both the quantity and composition of these effluents vary considerably, depending on the geographical and climatic conditions, tree age, use of pesticides and fertilizers, olive type, harvest time, maturity stage, and used extraction technology. Generally, the effluents from olive oil production are characterized by an acidic pH value, high concentration of biodegradable organic matters, variable content of macronutrients, micronutrients and heavy metals, and notable content of phenolic compounds which is why these streams are toxic and have negative environmental impact. Due to the seasonal operation mode of oil mills, the most of effluents are generated in huge quantities over short period of time making them more complicated to treat than effluents from other agricultural and industrial activities. Despite that, the numerous strategies towards zero emissions approach have been proposed for the reuse, valorization and degradation of effluents from olive oil production. Since the possibilities of biocatalyst cultivation on various substrates are almost unlimited, the utilization of olive oil mill effluents in biotechnological production of valuable bioproducts, including enzymes, biopolymers and biofuels, represents an ideal option from the view-point of economic and environmental sustainability.

Keywords: *Biotechnological production, bioproducts, olive oil mill effluents, waste management, sustainable development*

Acknowledgment: *This study was supported by the Ministry of Education, Science and Technological development of the Republic of Serbia (project number 451-03-68/2022-14/200134).*

THE EFFECT OF CULTIVATION TECHNIQUE ON ENZYMES PRODUCTION FROM WHEAT STRAW BY *Aspergillus* sp.

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Abstract

Sustainable management of residues from agricultural production is considered as an important strategy for conservation of natural resources and maintenance of environmental quality. Wheat straw, a by-product obtained after harvesting of wheat grains, is one of the most abundant lignocellulosic biomasses among agricultural residues in the world. It is usually left in the field and burned year after year, thus creating environmental issues. Considering that wheat straw is rich in carbon sources, it represents suitable raw material for biotechnological production of various enzymes, which play a significant role in the degradation of different agro-industrial by-products and wastes before their bioconversion into value-added products. This study is concerned with the effect of different cultivation techniques on enzymes production from wheat straw by strain *Aspergillus* sp. isolated from the environment. Cultivation of selected producing microorganism was carried out under the same bioprocess conditions using five techniques. Bioprocess efficacy was estimated based on the cellulolytic and xylanolytic activity of prepared enzymes mixtures. The obtained results indicate that the selection of cultivation technique had significant effect on the production of examined hydrolytic enzymes. It was confirmed that submerged cultivation with spontaneous aeration is the best cultivation technique for the production of cellulases and xylanases from wheat straw by applied *Aspergillus* isolate. On the other hand, solid state cultivation of producing strain under intensive aeration resulted in the lowest production of both investigated enzymes. The obtained results are the basis for further research aimed to increase the enzymes yield and activity of their mixture.

Keywords: *Biotechnological production, enzymes, wheat straw, cultivation technique, sustainable waste management*

Acknowledgment: *This study was supported by the Ministry of Education, Science and Technological development of the Republic of Serbia (project number 451-03-68/2022-14/200134).*

GREEN ALTERNATIVES IN ENVIRONMENTAL PROTECTION- PLANTS AS HYPERACCUMULATORS OF HEAVY METALS IN PHYTOREMEDIATION

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Abstract

Throughout the substantial increase in the anthropogenic activities, industrialization, urbanization and infrastructure works, intensive and incompetent use of fertilizers, along with rapid human population growth, heavy metals or potentially toxic elements such as cadmium (Cd), arsenic (As), nickel (Ni), chromium (Cr), lead (Pb), and mercury (Hg) have entered the soil and contaminated it. This represents a serious and significant threat to the environment that leads to further damage to the overall ecosystem structure and functioning. Ecotoxicological effects of metals on agricultural, forest, field and aquatic ecosystems, as well as toxicological effects to humans, have been well documented in literature. The most suitable methods for overcoming this problem of environmental pollution are biological remediation technologies, in which green plants are used. The utilization of higher plants to treat pollution is known as phytoremediation. Phytoremediation is the most promising, cost-effective, eco-friendly and sustainable technology, and nowadays it represents commercial and sustainable phyto management. This paper provides an overview of the most important plant species that are hyperaccumulators of heavy metals in the soil, contamination of soil by these pollutants, their distribution and ways of absorbing by plants. The aim of the paper is to emphasize the importance of using green alternative and more economical phytoremediation technology, with special reference to future perspectives and the new advances in remediation technologies. A comparative review of the literature so far has in detail discussed the applicability of higher plants in the method of phytoremediation and led to the conclusion that this technology is more acceptable, modern and economical tool than the other conventional technologies.

Keywords: *Heavy metals, Pollution, Higher plants, Phytoremediation.*

SUBSTITUTION ACIDITY, PHOSPHORUS AND POTASSIUM CONTENT IN THE LAND OF THE BRANIČEVO DISTRICT IN THE REPUBLIC OF SERBIA

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Abstract

During 2018, on the territory of the Braničevo district in the Republic of Serbia, the agrochemical analyzes were used to examine the substitution acidity, the content of easily accessible phosphorus and potassium for 4322 soils under fields, 152 meadows, 208 orchards and 95 vineyards. Soils under fields, meadows, orchards and vineyards showed significant variations at depths from 0 to 30 cm in terms of substitution acidity and content of easily accessible phosphorus and potassium depending on the location, purpose and application of mineral fertilizers. Substitution acidity for all surveyed soils varied in the range from 3.45 to 8.03, with the lowest average value expressed by meadows (5.14), and the highest by soils under vineyards (6.11). Acidic and strongly acidic reaction ($\text{pH}_{\text{KCl}} < 5.5$) had 68.2% of examined meadows, 58.8% soils under fields, 56.3% orchards and 55.8% vineyards. Most of the examined soils showed poor phosphorus supply. The average values of easily accessible phosphorous content of field, meadow and soil under vineyards were less than $10 \text{ mg } 100 \text{ g}^{-1}$ per soil. Among group of soils with poor phosphorus supply ($\text{P}_2\text{O}_5 < 10 \text{ mg } 100 \text{ g}^{-1}$) was 83.2% vineyards, 75.5% soils under fields, 74.2% meadows and 62.5% orchards. The average values of easily accessible potassium from examined soils under fields, meadows, orchards and vineyards were above $20 \text{ mg } 100 \text{ g}^{-1}$ per soil indicating a good supply of this element. Value of K_2O above $20 \text{ mg } 100 \text{ g}^{-1}$ per soil was shown in 68.8% orchards, 62.5% soils under fields, 61.1% vineyards and 60.3% meadows.

Keywords: *Substitution acidity, Phosphorus, Potassium, Soils, Braničevo district.*

THE LAND CONSOLIDATION AND STRATEGIES FOR AGRICULTURAL LAND PROTECTION

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Abstract

In this research the authors investigate the capacity of land consolidation for agricultural land protection. The significance of agricultural land is expecting to rise in the future because of its scarcity and decrease of its potential of food production. Those facts from the aspect of increasing human population and the agricultural land as a main source of food imply that every measure for land protection is justified. Land consolidation as a proven model for agricultural land management can also include the agricultural protection in the phase of its design. The authors state that, if aspect of agricultural land protection in the phase of land consolidation design is neglected, it is difficult to remedy the negative consequences on agricultural land in long period. In the paper some theoretical and practical aspects of agricultural land protection are discussed including agricultural land deterioration caused by erosion and/or desertification and possibility to prevent or mitigate their negative effects by land consolidation. The economic analysis also implies that land consolidation activities are the best chance for implementing strategies for agricultural land protection by including the land protection goals into the set of land consolidation goals.

Keywords: *Sustainability, Food production, Efficient land use, Land consolidation goals*

EFFECT OF *FALLOPIA JAPONICA* ON SOIL MICROBIAL ACTIVITY DEPENDS ON VARIOUS CLIMATIC AREAS

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Abstract

Biological invasions are one of the main threats to natural ecosystems and the impact of invasive plant species on native species, communities, ecosystems and soil biota has been widely recognized over the last decades. The number of invasive plants and their distribution is increasing in many parts of the world. *Fallopia japonica* (Houtt.) Ronse Decr. (Japanese knotweed) is considered to be one of 100 worst invasive species in the world. The aim of this study was to report that invasive plant species *F. japonica* had an impact on physico-chemical properties and microbial indices in soil ecosystems. The research was carried out in ten research sites in three different climatic areas of Eastern Slovakia. Soil reaction, soil moisture, soil organic carbon, soil basal respiration and soil enzyme activities (FDA, beta-glucosidase, acid and alkaline phosphatases) were determined. Obtained data were compared with uninvaded adjacent sites. Generally, the studied plant invader altered soil parameters, but those changes varied among selected localities. Correlation relationships were found between the individual parameters depending on the location and altitude. The results also suggested that large-scale invasion by *Fallopia* species was, therefore, likely to seriously affect biodiversity and reduce the quality of ecosystems.

Keywords: *Invasive species, Soil indices, Soil enzymes, Climate Areas.*

CONTENT OF RISK ELEMENTS IN TECHNOSOLS AND THEIR INFLUENCE ON SELECTED SOIL PARAMETERS

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Abstract

Mining bodies as remains of mining activities are a source of risk elements that contaminate individual components of the environment and may seriously danger human health. The mining area of Dubník opal mines (Eastern Slovakia) is known for mining gold, silver, and antimony, but above all, it is a world-famous opal deposit. The study aims to determine the content of risk elements (As, Cd, Cu, Fe, Hg) in soils taken from mining bodies (6 heaps of mining material, 6 open mining pits) and to evaluate their impact on the activity of soil enzymes (urease, acid, and alkaline phosphatase, fluorescein diacetate, and β -glucosidase), nutrient content (Na, K, Mg, Ca) and soil reaction (pH). The aim of the research was also to compare the state of pollution between two types of mining bodies and the influence of pollution on selected soil characteristics. The content of hazardous substances in the soils reached extremely high and above the limit values, especially on the heaps of mining material. Urease was evaluated as the most sensitive soil enzyme while β -glucosidase showed the highest resistance to contamination. The content of Na, K, and Mg was significantly higher on the heaps of mining material compared to open mining pits.

Keywords: *Opal mines, Soil enzymes, Former mining area, Slovakia.*

MATHEMATICAL MODELING OF PHOTOSYNTHETICALLY ACTIVE RADIATION IN BURGOS, SPAIN, AND THEIR APPLICATION TO OTHER CLIMATES

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Abstract

Photosynthetically Active Radiation is the fraction of the solar spectrum with a wavelength range between 400 and 700 nm, that produces biochemical processes, and also influences vegetation growth. Therefore, PAR is part of the visible light spectrum band (400-780 nm). Due to the scarcity of PAR data from direct measurements at ground meteorological stations, it is common to estimate it using mathematical models that depend on other more commonly measured meteorological and climatic variables: solar global irradiance, temperature, relative humidity. Many of the models developed to estimate PAR, found in the literature, are carried out through linear regressions (considering a single variable) or multilinear regressions (considering the simultaneous influence of several variables). In addition, in recent years, artificial neural networks (ANN's) have also been used, with different meteorological indices as input variables. In this work, both procedures, multilinear regressions and ANN's, have been used for modeling PAR in Burgos, Spain, under all sky conditions. The sky classification has been carried out using the sky clearness classification, k_t . Both procedures have been also used to develop a model with all the experimental data, regardless of the sky type. Once the models were developed in Burgos, which has a continental Mediterranean climate (according to the Köppen classification), they have been fitted in other locations with different climates. The experimental data were obtained from 7 meteorological stations belonging to the SURFRAD network in the USA. The objective of this work is to verify the suitability of the models developed in Burgos to other locations with different climate. The results obtained prove the good fit of the models developed in Burgos to the SURFRAD weather stations.

Key words: *photosynthetically active radiation (PAR), mathematical modeling, machine learning, climates.*

CALCULATION OF INTERCEPTED PHOTOSYNTHETICALLY ACTIVE RADIATION (IPAR) FOR INDUSTRIAL CROPS IN CASTILLA Y LEÓN, SPAIN

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Abstract

Agriculture is one of the most important economic activities in the Castilla y León region (Spain), as more than 20% of the land area is used for this purpose. There are many factors involved in its productivity, but a decisive climatic variable which is often not considered is the Intercepted Photosynthetically Active Radiation (IPAR). It is directly involved in photosynthesis process and it is usually estimated from a Beer's Law approach. To apply this law, it is necessary to know other parameters: *PAR* (Photosynthetically Active Radiation), *k* (light extinction coefficient) and *LAI* (Leaf Area Index). Industrial crops, including sugar beet, rapeseed and sunflower, are becoming very relevant in Castilla y León. In particular, sunflower area is increasing every year, reaching 242.432 ha in 2021. The IPAR values of the three types of industrial crops were calculated and spatially represented using Geographical Information Systems (GIS). The highest IPAR values were reached for sunflower and sugar beet. This is because the planophile leaves of sunflowers and sugar beet can intercept more solar radiation than rapeseed. Therefore, the LAI is one of the most influential factors in its calculation, as it varies depending on the development stage of the crop. The ability of canopies to intercept PAR has a positive impact on their growth and, consequently, on their productivity. For this reason, studying variables such as IPAR has a potential application in agronomic management and in improving crop production efficiency.

Keywords: *GIS, industrial crops, intercepted photosynthetically active radiation, sunflower.*

CHARACTERIZATION OF GLOBAL IRRADIANCE, ULTRAVIOLET RADIATION AND PHOTOSYNTHETICALLY ACTIVE RADIATION IN BURGOS, SPAIN

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Abstract

Solar radiation (SR) is essential in many areas of human activity. In the energy context, especially in renewable energies, the broadband solar radiation is converted into useful heat or electricity. Ultraviolet radiation (UVR) with a wavelength between 100 and 400 nm is responsible for a huge variety of photochemical reactions (Jacovides et al., 2009) and, especially in its shorter wavelengths, has deleterious effects in many biological systems. In people, it can cause damage to the skin (premature aging, burns, skin cancer...). Finally, photosynthetically active radiation (PAR), with a wavelength between 400 and 700 nm, is a key factor in agriculture, as it is the energy source capable of triggering photosynthesis, which makes food and biomass production possible (I., Alados, I. and L., 1996). Despite the obvious interest in the knowledge of the spectral distribution of SR, the number of measurement sites in most areas of the world is scarce. Therefore, the lack of data means that UVR and PAR are usually estimated as a constant fraction of broadband solar irradiance. However, these ratios are affected by atmospheric conditions, mainly due to absorption and diffusion effects of SR across different regions of the spectrum. The objective of this work is to study the variation of the UvGH-RaGH and PAR-RaGH ratios as a function of the sky type classified according to the CIE standard at different time intervals (ISO, 2004). For this purpose, a 36-month experimental campaign was carried out in which data on atmospheric variables were collected together with illuminance and radiation data (UvGH, PAR and RaGH). After analysing the data, it can be concluded that there is a high correlation between UvGH-RaGH and PAR-RaGH (R2 value of 0.968 and 0.995 respectively), having obtained that the UvGH-RaGH ratio is 4.94% and the PAR-RaGH one is 39.1%.

Key words: *global irradiance, ultraviolet radiation, photosynthetically active radiation, vegetation growth.*

WATER MANAGEMENT IN TUNISIA

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Abstract

Tunisia is classified among the least water resources endowed countries in the Mediterranean basin with underground water resources. The volume of available water is estimated at 450 m³/person/yr. In 2030 this is expected to fall to 315 m³/person/yr. Conventional water resources throughout the country amount to 4,670 MCM/yr, 2,700 MCM of which is surface water and 1,970 MCM is groundwater. The non-conventional resources are limited to treated household wastewater, which amounts to 250 MCM. As for quality, about 72 % of the surface water has a salinity of more than 1.5 g/l. Percentage of 71 % of the groundwater has a salinity level varying from 1.5 to 5 g/l and the remaining 29 % exceeds a salinity of 5 g/l and becomes brackish water. Thanks to the adoption of rational and modern management of its water resources, Tunisia, despite the scarcity of its water resource, has been able to develop its agricultural and economic sectors linked to the water resource in a sustainable manner. Agriculture, which consumes 80% of natural water resources, has adopted a modern distribution system using water conservation and water reuse. The strategy of water resource mobilization and use constitutes an essential component of the economic and social development of Tunisia. This strategy assures the security of food supplies, improves the quality of urban, rural and Saharian life and assures water supplies in the industrial and tourist sectors. It integrates the management of surface and ground water resources as well as natural and non-conventional resources; and has set in place a mechanism of the optimization of water use through the efficiency of use, water conservation, reduction of loss and waste and the protection of water sources.

Keywords: *water resource mobilization, strategy, management, Tunisia.*

EXAMINATION OF FARMERS' PERSPECTIVE ON PASTURES IN TERMS OF SUSTAINABILITY AND ENVIRONMENT

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Abstract

Recent developments in agriculture have stirred up interest in the concept of “sustainable environment” farming systems. Rangelands in Turkey constitute a very important natural resource as they occupy 16.59 % of the total surface. Rangelands, especially in developing countries, are important in terms of animal nutrition, maintaining a sustainable environment, ensuring plant diversity and protecting soil and water erosion. The main purpose of this research is to determine the perceptions and thoughts of farmers in order to determine the relationship of pasture areas with the environment. For this purpose, a face-to-face survey was conducted with 271 farmers in the provinces where pasture and improvement studies were carried out. The questionnaire includes categorical variables related to the socio-economic characteristics of the farmers and their perspectives on pastures. The chi-square test was used to examine the relationships between the variables. Bonferroni corrected Z test was applied to compare the ratios in cases where there were significant relationships. According to the descriptive statistics obtained, 78.2% of the farmers consider pastures as just a pasture area. 21.8% of the farmers think that pastures are important for the environment (in terms of protecting soil and water resources and providing natural beauty). As a result of the analyses, it was determined that the rate of finding pastures important for the environment is higher for young farmers or those with a high level of education compared to other farmers ($p < 0.05$). Study findings suggest developing an appropriate extension services framework to raise awareness for sustainable rangeland and environmental protection.

Keyword: *Demographic characteristics of farmers, Rangelands, soil erosion, Sustainable environment, Türkiye*

A NOVEL APPROACH TO THE ENCAPSULATION OF THYME ESSENTIAL OIL

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Abstract

Thyme essential oil appears to be an attractive natural alternative with high bioactive compounds for food preservation applications. The electrospraying technique can encapsulate bioactive food compounds to produce engineered solid particles to improve the stability and availability of bioactive compounds. This study assessed thyme essential oil (TEO) encapsulated maltodextrin (MD) particles produced by the electrospraying technique. Engineered MD-TEO particle morphology and antimicrobial activity and antioxidant potential were evaluated. The morphology of obtained particles was evaluated by scanning electron microscopy (SEM) and optical microscopy. Also, the structure of engineered particles was analyzed by Fourier-transform infrared spectroscopy (FTIR). The antioxidant activity was evaluated by the cupric ion-reducing antioxidant capacity (CUPRAC) method. The antimicrobial activity was assessed *in-vitro* against five reference bacterial strains. Engineered MD-TEO electrosprayed particles exhibited high antioxidant activity and antimicrobial activity against *Bacillus cereus*, *Staphylococcus aureus*, *Listeria innocua*, *Escherichia coli*, and *Salmonella enterica* subsp. *enterica* serovar Typhimurium. Engineered particles were spherical and homogeneous. The results of this study showed that electrospraying is a promising particle engineering technique for obtaining MD-TEO food-grade particles. In addition, thyme essential oil encapsulated maltodextrin particles have the potential to be utilized as a natural preservative for improving food safety and quality.

Keywords: *Electrospraying, Thyme Essential Oil, Maltodextrin, Food Safety.*

**POTENTIAL ANTIMICROBIAL ACTIVITY OF HERBAL ESSENTIAL OILS
AGAINST *Vibrio anguillarum* ISOLATED FROM RAINBOW TROUT (*Oncorhynchus
mykiss*)**

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Abstract

Herbal essential oils are used as an alternative medicine to antibiotics in the treatment of fish diseases. *Vibrio anguillarum*, which is the causative agent of vibriosis, mostly occurs with seasonal changes in water temperature, causes exophthalmos and hemorrhages in fish, and causes economic losses in fish farms. *V. anguillarum* strains isolated from symptomatic trout at different times of the year and identified by MALDI-TOF MS were used. The effects of essential oils of papermint (*Mentha piperita*), lemon (*Citrus limon*), lavender (*Lavandula angustifolia*), tea tree (*Melaleuca alternifolia*) and rosemary (*Rosmarinus officinalis*) were used to determine MICs values, using the microdilution method. The 24 hours antimicrobial activities of mint, lemon, lavender, tea tree and rosemary essential oils were shown to be diverse on MICs values.

Key words: Antimicrobial activity, *Vibrio anguillarum*, essential oils, MALDI-TOF MS

EVALUATION OF BEST MANAGEMENT PRACTICES FOR CONTROLLING SEDIMENT AND NUTRIENT TRANSPORT AT THE DEVELI BASIN, TURKEY

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Abstract

In this study, a watershed-scale Soil and Water Assessment Tool (SWAT) model was developed for the Develi Basin (Turkey) and the effects of best management practices to control sediment and nutrient transport were evaluated with the model. The Develi Basin is a semi-arid agricultural basin located in the Central Anatolia Region of Turkey, where irrigated agriculture has been intensified significantly in recent decades. Agricultural drainage from irrigated areas has caused reduction in the quality of surface water bodies. Water quality and sediment and nutrient transport in the basin were simulated with SWAT. Six management scenarios that can reduce sediment and nutrient transport were determined considering the feasibility of the applications and evaluated with the model. The scenarios were as follows: 1) Reduction in fertilizer use by 10% 2) Reduction in fertilizer use by 20% 3) Conservation tillage 4) No tillage 5) Vegetated filter strip (2 m) 6) Vegetated filter strip (5 m). The model performed well for simulating sediment and nutrient transport in the Develi Basin during calibration and validation. The simulation of individual scenarios revealed that vegetated filter strips showed the highest sediment and nutrient reduction, followed by no tillage and conservation tillage practices. This study showed that sustainable watershed management can be achieved by application of best management practices in agricultural areas in the Develi Basin.

Keywords: *Water Quality Modelling, SWAT, Best Management Practices*

WATER FOOTPRINT OF APRICOT PRODUCTION: A KEY EXPORTED CROP IN TURKEY

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Abstract

Apricot is one of the key crops of Turkey, which was identified within the framework of CREATE Project (funded by H2020 ERANET FOSC program and TUBITAK(220N242)). The aim of the project is to investigate cross-border climate vulnerability of Turkish, European and African food systems. Four key traded crops were identified for Turkey: figs, grapes, hazelnuts and apricots. Apricot production is carried out on average area of 128.000 hectares in Turkey. Malatya, which has 65% share in the apricot production, ranks first with an average area of 82 thousand hectares. In 2020, 833.398 tonnes of apricots were produced in Turkey, of which 352.050 tonnes of the production was in Malatya. More than 152.000 tonnes of apricots were exported in 2020, of which 88.000 tonnes was dried (72% of the export in the world) and contributed \$260 million to country's economy. The global average water footprint(WF) of apricot is 1287 m³ per tonne; where green WF is 694 m³ and blue WF is 502 m³. This means that apricot production in Turkey requires considerable amount of water via precipitation and irrigation. These data show that annual total WF of apricot production is 1 billion m³. According to the drought models, Malatya is one of the areas which has high drought sensitivity. Furthermore, annual precipitation of Malatya is below the country average (573 mm) with 350 mm. Considering drought risks and relatively high WF of apricot production, there is an urgent need to find solutions to sustain production yields and protect water resources.

Keywords: *apricot, export, water resources.*

RECOVERY AND UTILIZATION ANALYSIS OF PAPER AND PAPERBOARD BY YEARS IN TURKEY

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Abstract

The production of recycled paper shows an increasing trend in our country as well as in the world. Raw material production of recycled paper is provided by collecting waste paper cardboard. The aim of the study is to provide recovery and utilization analyzes of recycled paper which reflects the progress of the waste paper management process in the short-term process. The use of paper-cardboard and its products, which is increasing day by day, shows a rising trend due to the more intense use of online commerce during the pandemic. Despite the increase in the demand for paper-paperboard and its products, the amount of paper raw materials needed is also increasing linearly. Some problems are encountered in the supply wood supply, which is the primary lignocellulosic raw material, and in the production of virgin paper obtained from this raw material. The decrease in forest resources and the inability to ensure sustainability also cause the primary paper production unit cost to be high and have higher environmental pollution parameters resulting from production. As an alternative to the primary raw material source, waste paper and its products are needed as secondary raw materials. Recovering of waste paper its products as recycled paper has an important contribution to ensure environmental protection and sustainability of waste paper-paperboard resources. Recycled papers were analyzed to and discussed between the years 2009-2021 using the formulation of recovery and utilization rates. In the two-year period including Covid-19 2020-2021, there was a total increase of 12.63% in waste paper consumption.

Keywords: *Waste paper, Recovery rate, Utilization rate, recycled paper*

SUITABILITY OF SOME OAK SPECIES FOR PAPERMAKING

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Abstract

The paper qualities of oak species such as *Q. robur* (English oak), *Q. petraea* (Sessile oak) and *Q. frainetto* (Hungarian oak) and *Q.cerris* (Turkey oak) were evaluated for pulp raw material availability. For this purpose, some pulp properties such as between fiber dimentions and fiber dimation relationships were investigated. Schultze (1857) was used as the maceration method after the oak species were cut into pieces in the size of chip. Then, fiber dimensions such as fiber length, fiber width and cell walls were measured and evaluated from the prepared microscope slides. According to the results; Among the oak species, the longest fiber length is *Q. cerris* 1.337 mm and the shortest fiber length is *Q. robur* 1.018mm. The fiber length levels of *Q. petraea* and *Q.frainetto* species were determined as 1.103 mm and 1.062 mm, respectively. It was determined that the thickest diameter average of the oak species belonged to sessile oak (27.6 µm), while the thinnest fiber diameter was determined to belong to the stemless oak (6.3 µm). It was determined that the fiber lengths of oak species are between the maximum hardwood fiber lengths. While fiber length is an important variable that positively affects papermaking, fiber thickness and cell wall variables are also important determinants. Thus, the relationships between fiber dimentions and fiber dimation of oak species were determined separately for each species on their suitability for use in pulp production was evaluated and it was determined that they were not suitable as raw materials in papermaking.

Keywords: *Q. robur*, *Q. petraea*, *Q. Frainetto*, *Q.cerris*, *fiber morphology*, *pulp production*, *fiber morphology*

RAW MATERIAL CHARACTERIZATION OF WASTE PAPER

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Abstract

The use of waste paper as raw material is increasing day by day in the world and in our country. Determining the raw material characterization of waste paper is important in explaining both the raw material and the properties of the product to be produced. The raw material characterization of three types of waste paper, consisting of 1st grade 1st quality office paper, corrugated box scraps and gray cardboard determined within the scope of the study, was carried out. The analyses made in terms of raw material characterization were; fiber length and fiber width from fiber morphological characteristics; ash content (%), fines content (%), filler content (%) and SEM images. Fiber length (1.289 mm) and fiber width (20.440 μm) of 1st grade 1st quality office paper are higher than that of other papers. Corrugated box scraps have the lowest fiber length (1.124 mm) and fiber width (17.450 μm). Regarding ash content, while it was mostly found in gray cardboard (16.7%), it was found the least in corrugated box scraps (13.7%). It was determined that the amount of fines (%) was highest in 1st grade 1st quality office paper (21.25%) and the least in corrugated box scraps (7.68%). It was determined that the filler amount was highest in 1st grade 1st quality office paper (6.71%), and the least in corrugated box scraps (3.77%). No significant deformation of the fibers was observed in SEM images. 1st grade 1st quality office paper was supported by SEM images where the amount of filler was high.

Keywords: *Waste papers, Fiber morphology, Ash content, Fines content, SEM images*

USE OF LEMNA MINOR IN PHYTOREMEDIATION PROCESS FOR REMOVAL OF HEAVY METALS IN SECONDARY PULP

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Abstract

Chemicals, colorants and ink components from secondary fibers used as raw materials in the production of recycled paper cause heavy metals to increase in the structure of paper-cardboard. As a food packaging, it threatens human health by being exposed to heavy metal migration as a result of direct interaction with food or by contamination during the final processing of the packaging. It is aimed to decrease and removal heavy metal concentrations as result of phytoremediation process applications with the interaction of recycled pulp from waste packaging paper-based samples with *Lemna minor*. And also create a positive impact on current environment by plant production as the method. *Lemna minor* samples were obtained from Turkey's Nazlı Lake (Yedigöller National Park, Bolu). The lead, zinc, cadmium, nickel, copper, chromium and aluminum heavy metal decrease and removal efficiencies of the recycled pulp samples were applied in batch reactor system at a temperature of approximately 27-28°C for 7 days. For metal determination analysis, the samples were prepared by burning them gradually in a microwave device to bring them into solution. Heavy metal determinations were made with the ICP-OES device. It has been shown that the *Lemna minor* plant can be used with high efficiency in the processes of removing heavy metals and reducing heavy metal concentrations in recycled pulp. At the same time, it was created a positive effect on the environment with its plant production and appearance, without polluting the environment by decreasing and removing heavy metals pulps from waste paper, cardboard and corrugated cardboard.

Key Words: *Lemna minor*, heavy metals, waste paper, recycled pulp, seconder pulp

EVALUATION OF SOIL PROPERTIES OF TEKİRDAĞ PROVINCE THROUGH MAPS

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Abstract

Soil is one of the most essential natural resources that support food production and provide ecosystem services up-to-date soil information is needed to ensure the sustainable use of soil resources, which are under pressure due to rapid population growth, high food demand, and improper land use. Therefore, soil mapping studies based on the Geographical Information Systems (GIS) techniques have gained importance in recent years. In the present study, we aimed to evaluate the soil characteristics of Tekirdağ province using maps. Evaluation of the geographic distribution of soil characteristics using maps in Tekirdag province is important in terms of identifying and solving agricultural problems where rapid population growth and misuse of land have been observed in the last century. Soil data obtained through literature review, fieldwork, and soil analysis were combined with Digital Soil Mapping (DSM) approach. The results show that different soil types emerge under different geographical factors varying temporally and spatially. Furthermore, various soil properties have occurred under the influence of pedogenic factors in the study area. Accordingly, the spatial distribution of the soil properties such as depth, texture, drainage, organic matter, reaction, lime, and salinity was determined. In addition, soil maps of the study area were produced in accordance with the former and new classification systems. The former soil classification map indicates that zonal soils are dominated in the area which consists of brown forest soils, red-brown Mediterranean soils, non-calcareous brown forest soils, and non-calcareous brown soils, which generally reflect the effects of climate and vegetation. According to the soil taxonomy classification system, it has been determined that 6 different soil orders are distributed in the study area: Alfisol, Andisol, Entisol, Inceptisol, Mollisol and Vertisol.

Keywords: *Soil types, GIS, Digital Soil Mapping (DSM), Tekirdağ.*

IN VITRO ANTIPARASITIC EFFECTS OF SOME ESSENTIAL OILS ON CRYPTOCARYON IRRITANS THERONTS

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Abstract

White spot disease, which is caused by the ciliate protozoan *Cryptocaryon irritans*, is considered to be one of the most important diseases in cultured marine fish. Currently, chemical treatments are the main treatment method used, but they have adverse effects on the environment and fish. Recently, use of herbal products against parasitic fish diseases have increased due to their less adverse unwanted secondary effects on the environment and fish. This *in vitro* study is conducted to examine anthelmintic effects of peppermint (*Mentha piperita*), lemon (*Citrus limon*), lavender (*Lavandula angustifolia*), tea tree (*Melaleuca alternifolia*) and rosemary (*Rosmarinus officinalis*) essential oils against *C. irritans* theronts. In the *in vitro* experiments, 50, 25, 12.5, 6.25, 5 and 1% concentrations of these essential oils were applied for 20 minutes on *C. irritans* theronts. At the highest concentration (50% concentration), in 1 minute, peppermint essential oil caused 70% cumulative mortality in *C. irritans* theronts, while other tested essential oils resulted in 100% mortality. At the lowest concentration (1% concentration), the observed cumulative mortalities after application of peppermint, lemon, lavender, tea tree and rosemary essential oils for 4 minutes were 0%, 70%, 80%, 90% and 100%, respectively. Based on the *in vitro* tests, all essential oils are considered to have dose and duration dependent anthelmintic effects against *C. irritans* theronts.

Keywords: *Cryptocaryon irritans*, white spot disease, essential oil, antiparasitic effect

PESTICIDES POLLUTION FROM AGRICULTURE ACTIVITIES IN THE ALTINAPA RESERVOIR WATERSHED, TURKEY

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Abstract

The Altınapa Reservoir is a drinking water reservoir, which supplies water to the city of Konya (Turkey) with population of about 2.5 million. In this study, water quality and pesticide concentrations were monitored at 4 points on the river and at reservoir effluent during one year between 2019 and 2020. Water quality parameters including pH, electrical conductivity (EC), total hardness, alkalinity, total organic carbon (TOC), total nitrogen (TN), nitrate, and total suspended solids (TSS) were monitored monthly. Pesticides concentrations were measured at the seasonal samples collected at the same sampling points. The annual mean value of pH and EC were 8.04 and 417 $\mu\text{S}/\text{cm}$, respectively. While annual mean TOC concentrations varied between 1.35 and 1.69 mg/L in samples collected from the stream, it was 2.69 mg/L in the reservoir outflow. The annual mean TN and $\text{NO}_3^- \text{N}$ values were 2.39 and 1.25 mg/L, respectively. Pesticide monitoring results for four periods showed that 71 different micropollutants including pesticides were detected. Among these micropollutants, 19 pesticides were observed in at least two sampling points and/or reservoir effluent. Acetamiprid, permethrin, piperonyl butoxide and terbutryn were observed at least two seasons. The concentrations of DDD-op, DDE-p.p' and diflufenican exceeded the environmental quality standards. Managing agricultural activities in the basin is important in order to protect human health and aquatic life from pesticide pollution. Within the scope of the project, the effects of reducing the use of fertilizers, changing the plowing technique, and applying filter strips to the stream sides were evaluated in agricultural practices.

Keywords: *Agriculture, Altınapa Reservoir Watershed, pesticide pollution, water quality.*

SUSTAINIBILITY of IRRIGATION

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Abstract

The concept of sustainability is defined as meeting the needs of the present without compromising the needs of future generations. The realization of sustainable water/irrigation management depends on establishing an environmental, economic, and social balance. Establishing this balance is linked to sustainable development, as it requires the allocation of water among competing sectors such as agriculture, industry, and human activities etc. according to needs. Irrigation is one of the most important parameters in the emergence and maintenance of the green revolution and irrigated area provides 40% of the world's food production. From this point of view, irrigation makes a serious contribution to the sustainability of food production. On the other hand, doubts arise regarding the sustainability of irrigation due to global warming and related climate change, population growth, scarcity of soil and water resources, and poor management of irrigation networks. Evaluated from this aspect it is imperative to ensure the sustainability of ecosystems, which have become increasingly fragile because of human activities, and to make an evaluation with a holistic approach in irrigation, as in other activities. For this purpose, it is necessary to increase the efficiency of water use for sustainable irrigation, to distribute water equally and to prevent salinization, and to reduce environmental effects such as deterioration of water quality. At this point, it will be possible to reduce the pressure on water resources by using irrigation techniques that reduce water use with an acceptable reduction in agricultural production, and thus, it will be possible to meet the urban and environmental water demands with the saved water.

Key words: *Irrigation management, Agriculture water use, Irrigation efficiency, Water management.*

DEVELOPMENT OF AGRICULTURAL WATER QUALITY INDICES FOR UKRAINE

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Abstract

The cultivation of environmentally friendly agricultural products is limited by the quality of soils, water resources, etc. The results of monitoring the state of natural waters, organized according to the existing scheme, which is based on the comparison of water composition with MPCs, do not answer the main question: whether water sources are suitable for a particular type of water use; how, based on long-term data, to give a valid forecast of quality change for decades, to determine critical parameters. We propose a conception of national water quality indexes for agriculture applications – irrigation, including drip, fertigation, greenhouse soils, for low-volume substrates. Idea is to unite the agronomic, ecological, and technical requirements in a 100-scale numerical assessment using Harrington's desirability function. In contrast to SAR, or WQI NSF, it is possible to combine any quantity of quality parameters in one result. In addition, it is possible to differentiate the requirements by taking into account the types of soils and plants. The most controversial moment is how to determine the scale of water quality parameter differentiation (very good-good-satisfactorily-bad-very bad). The defect is that different normative documents and authors give different recommendations. It is clear because different countries have different environmental conditions, soils, waters, etc. We are based on Ukrainian requirements for the different types of surface waters, soils, and climate zoning and a few methods such as SAR, and Irrigation coefficient according to Stebler. Finally, we developed the Python WODA application for the calculation of WQI based on Harrington's desirability function.

Keywords: *National indexes, water quality assessment, agriculture, Ukraine.*

OCCURRENCE OF PHARMACEUTICALS AND PERSONAL CARE PRODUCTS (PPCPs) IN AQUATIC ECOSYSTEMS OF ALABAMA

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Abstract

Highly soluble pharmaceuticals and personal care products (PPCPs) released into surface waters contaminate aquatic ecosystems and have been shown to affect fish and animal populations adversely. In 2015, a total of 60 samples were collected from targeted watersheds across Alabama. PPCP concentrations were determined by US EPA Method 1694 for multi-residue analysis, using solid-phase extraction and ultra-performance liquid chromatography-electrospray tandem mass spectrometry (LC/MS/MS). The detection ranges for acetaminophen (26-45 ppb), bisphenol-A (150-220 ppb), caffeine (91-220 ppb), N, N-Diethyl-meta-toluamide (41-280 ppb), salicylic acid (62-84 ppb), sulfamethoxazole (22-120 ppb), and trimethoprim (13-16 ppb) revealed concerning levels. Water quality measurements were also taken for pH, temperature, and electrical conductivity. Electrical conductivity varied across the state, ranging from 263.9-411.6 mS/cm. Temperature and pH did not show significant spatial variation. A greater frequency of PPCP detection was shown to occur in south Alabama. This 2022 study investigates current PPCP levels at locations proximate to those of the 2015 study. The detection ranges of the contaminants and water quality indicators were compared to the previous data to determine trends. Our findings highlight the need for more efficient PPCP management as well as added evidence-based water quality guidelines.

Keywords: ecosystems, care products.

APPLICATION OF HIGH SALT-TOLERANT MICROORGANISMS IN ORDER TO IMPROVE THE QUALITY OF WASTEWATER FROM AQUACULTURE IN TIEN GIANG, VIETNAM

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Abstract

In Vam Lang district of Tien Giang province, in South Vietnam there is a high density of aquaculture with 15,749 ha area, in which the saltwater aquaculture area is 9,223 ha. The environmental problem is that the large amount of saline wastewater has been discharged to the river from this activity. The salinity of this wastewater can be calculated according to NaCl concentration of 3-30g/L. In saline wastewater with such high concentration there are few organisms, which can survive because of the protoplasm contraction. The aim of this study was to isolate and select high salt-tolerant microorganism in order to improve the quality of such saline wastewater. Therefore a method had to be developed for isolating and selection of the best salt-tolerant microorganism strains at a minimum salinity of 3%, with the treatment efficiency of $\text{NH}_4^+ > 50\%$ and COD (chemical oxygen demand) $> 70\%$. The best salt-tolerant microorganisms are isolated from the saline wastewater itself and also from high salinity wastewater sources such as from seafood processing factories, e.g. fish sauce factories. The idea was that these strains can have a good adaptation on salty water environment. As the result of the investigations it can be said that the saline aquaculture wastewater could be classified as well the appropriate strains of the microorganisms. Based on the findings group of strains of salt-tolerant microorganisms or a mixture of selected strains could be detected and described. A method for practical use for the best wastewater treatment could be described.

Keywords: *saline wastewater, aquaculture wastewater treatment, salt-tolerant microorganisms.*

ANIMAL HUSBANDRY

PERCENTAGE OF ACCEPTED GRAFTED LARVAE AND THE QUANTITY OF HARVESTED ROYAL JELLY RELATED TO THE NUMBER OF CUPS PER FRAME

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Abstract

The purpose of this trial was to evaluate the production of royal jelly, depending on the number of planted larvae per grafting frame. The trial was conducted in an apiary in Cërrik (central Albania) during the month of June, with two consecutive plantings, and a time distance of one week, with five grafting frames, which were introduced in five strong colonies. Royal jelly harvesting was done after 72 hours. The preparation of these colonies started seven days before the start of royal jelly harvesting. The following indicators are calculated: the number of grafting frames for each planting, the number of larval pups in each grafting frame, the number of larvae received and the amount of royal jelly produced per colony. At the end of the trial, it was noted that from one planting to another, a significant increase ($p \leq 0.05$) in the rate of larval acceptance was achieved (11.66%) and an increasing trend in the amount of harvested royal jelly per frame. A strong correlation was noticed between the larval acceptance rate and the amount of collected royal jelly ($r = 0.697$). Also, with the increase in the number of cups per frame (50, 100, 150) there was a decrease in the larval acceptance rate and a decrease in royal jelly production per cell. The best results were achieved when grafting frames with only one floor (50 cups) were used.

Key words: *Royal jelly production, grafted larvae percentage, grafting frame.*

STUDY OF ANOGENITAL DISTANCE IN RABBITS: EFFECT ON SEXUAL BEHAVIOR AND LITTER SIZE BIOLOGICAL COMPONENTS

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Abstract

The aim of this work is to study the relationship between the anogenital distance (AGD) measured before mating and plasma cholesterol and hormone concentrations (testosterone and 17- β -estradiol), sexual behavior, litter size and its biological components (ovulation rate and prenatal survival) 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 long 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 day 12 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 the AGDL group of females (14% and 24%, respectively). The AGDL females presented a 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 the AGDS females (34%; $P < 0.05$). The number of implanted embryos was significantly higher in the AGDS group (9.12 vs. 8.66 embryos). The embryonic, fetal and prenatal survival were significantly higher in the AGDS females. In addition, the AGDS females presented a higher litter size at birth (8.96 vs. 7.83; $P < 0.01$) and sex ratio in favor of male (61.60% vs. 41.00%; $P < 0.01$). In conclusion, the AGD measured before mating can be used as a predictor of the testosterone level, sexual behavior, litter size at birth and the sex ratio in rabbits.

KEY WORDS: AGD, hormones, morphology, prolificacy, rabbit, receptivity.

HISTOFUNCTIONAL CHANGES IN MAMMARY AND UTERINE STRUCTURES IN LATE PREGNANCY OF DOE RABBIT, ALGERIA

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Abstract

Our study aims to determine the functional modifications of uterine horns and mammary glands in doe rabbits at the end of pregnancy. The doe rabbits used in our experiment are 4-month-old females, belonging to the synthetic strain (SS). The control doe rabbits used are of the same age and empty does. The females were weighed and sacrificed by decapitation. Ovaries, uterine horns and mammary glands were removed, weighed and fixed with 10% formalin. They were analyzed for histological study with standard topographic staining with Hematoxylin-Eosin. A morphometric study was carried out using the AxioVision software, targeting the measurement of the different structures of the organs removed (ovarian follicles, myometrium, and endometrial glands, mammary acini). The measurements of the follicular and oocyte constituents reveal differences between the groups of females. Some microscopic parameters of the uterus reveal very significant differences ($P < 0.01$), with an increase in size of the myometrium and diameter of endometrial glands in pregnant does. A significant increase in epithelial proliferation, complexity of luminal folding, abundance of uterine endometrial glands and richly vascularized uterine lace were observed. The mammary gland of pregnant does is characterized by a very significantly larger diameter and increase of surface area of the acini and surface of epithelial cell ($p < 0.01$). These results show some variations of uterus and mammary gland, allowing both the gestation and lactation functions, carrying out a favorable environment for the development of embryos during gestation and preparing a mammary gland for lactation, in order to be carried out for a better survival of the newborn rabbits.

Keywords: *doe rabbit, ovary, uterus, mammary gland, gestation, histomorphometry.*

SEMEN PARAMETERS AND LIBIDO IN RABBIT BUCK OF TWO ALGERIAN GENETIC TYPES

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Abstract

The aim of our study was to compare the reaction time (libido) and semen characteristics in rabbits of the local Algerian population and synthetic line during the summer season. The semen samples were collected from 24 matured rabbit bucks from the local population and of synthetic line. Throughout our experiment, which lasted nine weeks, two successive ejaculates were collected once a week for each male of the two groups studied. Each ejaculate sample was subjected to libido and semen measurements. The results of the study showed that the local population and the synthetic line had similar ($p > 0.05$) libido (13.92 vs 16.85 s). Also, the overall means of gel free volume (0.88 vs. 0.87 mL), pH (7.51 vs. 7.65), and live sperm (56.21 vs. 55.88%) was similar in both groups. However, the local population had higher semen concentration ($398.50 \times 10^6/\text{mL}$ vs. $328.90 \times 10^6/\text{mL}$) and percentage of abnormal spermatozoa (36.54 vs. 30.28%) compared to the synthetic line. Moreover, the massal and individual motility ($p=0.006$ and $p=0.008$) were significantly increased in local population compared to the synthetic line. Concerning the motility parameters assessed by the CASA system, kinetic traits for the local population were significantly greater ($P < 0.05$) than those for the synthetic line, except VCL, ALH and BCF. Under Algerian High ambient temperatures conditions, it has been concluded that rabbit bucks of the Algerian local population had a good ability of adaptation to produce semen in a hot climate compared to the synthetic line.

Keywords: *Rabbit, semen, temperature, CASA, Algeria.*

EFFECT OF INSECTICIDE ADMINISTRATION ON THE FREQUENCY OF ENDOPARASITES IN RABBITS OF THE SYNTHETIC STRAIN

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Abstract

The aim of this work was to study the impact of the administration of a pesticide on the frequency of occurrence of different parasitic species found in the digestive tract and more precisely at the intestinal level in rabbits through an analysis of the digestive contents of sacrificed animals. The rabbits used in our study belong to the synthetic strain (more prolific and well adapted to Algerian breeding conditions). They are kept in a rational breeding system (individual cages, granulated feed distributed ad libitum, automatic and free-flowing watering). The experiment was carried out on a total of 20 females divided into two batches of 10 animals each (control batch (Tm) and the treated batch (Tr). The pesticide used was "Voliam Targo® 063SCe", an insecticide widely effective on several pests and recently marketed in Algeria. It's a combination of two insecticides : Abamectin and Chlorantraniliprole, belonging to two different chemical families (respectively avermectins and anthranilic diamides). The parasitological diagnosis of the digestive contents of the sacrificed rabbits was carried out at the laboratory of the University Mouloud Mammeri of Tizi-Ouzou, using the Ritchie technique. All the data recorded after this analysis were statistically studied. Microscopic examination of the digestive contents revealed the presence of three parasitic species: *Passalurus ambiguus*, *Eimeria* sp and *Giardia duodenalis*. The frequency of occurrence of these species varies from one species to another. The results obtained show that the control rabbits are the most infested compared to the treated rabbits. It was also found that Voliam Targo® has a more marked effect on pinworms compared to the two other species identified.

Keywords : *Digestive endoparasites, Voliam Targo®, rabbit, synthetic strain, Algeria*

EFFECTS OF ANO-GENITAL DISTANCE ON SEXUAL EXHAUSTION, PLASMA TESTOSTERONE LEVEL IN ALGERIAN LOCAL RABBIT BUCKS

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Abstract

The aim of the present work is to evaluate the sexual behaviour, hormonal profile of testosterone and ano-genital distance in Algerian local rabbit bucks, raised under the same conditions of breeding. A total of 10 rabbits, nine months old with mean of weight of the rabbit were 3.460 Kg. The mean AGD (Ano-genital distance) in the bucks used was 14.60 ± 2.0 mm. The results of this experiment showed relationship between AGD and weight ($P > 0.05$); as well as with some parameters of sexual behaviour, including chin marking, marking on females, marking with urine, overlapping, mating and aggressiveness. Also, the mean plasma concentration of testosterone 2.16 ± 1.4 ng/ml was not influenced by AGD. In this study, it can be concluded that the AGD not influence the sexual behaviour and plasma testosterone level in Algerian locale rabbit.

Keywords: *Rabbit buck, sexual behaviour, Ano-genital Distance, Algeria*

CAMEL BREEDING SYSTEMS IN ALGERIA: IMPACT OF ECOLOGICAL AND SOCIO-CULTURAL CHANGES ON LOCAL FARMERS

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Abstract

Algerian camel breeding plays an economic, social and cultural role and is part of the development of a policy in the animal production in the country. Dromedary represents an invaluable animal resource for the local population; it is a source of noble proteins found in milk and meat. The total number of camels tripled in 20 years reaching 416,519 head in 2019. This work is a study of the camel field, the first part concerns the breeding practices: type of breeding, size, structure and breeds of the herd. The second part concerns the milk productivity and finally the last part will deal with the difficulties encountered by the breeders in the Algerian south and the impact of climatic and socio-cultural changes on the breeders. The results obtained show the predominance of semi-nomadic livestock in the wilaya of Ghardaïa (65, 95%), nomadic livestock is almost non-existent (2.12%). On the contrary, in the wilaya of Tamanrasset nomadic livestock 43% and semi-nomadic livestock 13.8% are in the majority with a rate of while sedentary livestock represents 9%. The livestock system is mostly a free system. Half of the breeders have herds with less than 50 heads. The camel breeders are also breeders of goats and sheep. The Chaambi breed in Ghardaïa and the Targui breed in Tamanrasset are predominant. The milk productivity is quite low (2 to 6l/milking), with very little surplus milk production. This surplus is essentially used for self-consumption either in the form of milk, fermented milk or transformed into traditional cheese (Takammart). Different problems are reported by farmers; especially those related to animal feeding, indeed, the prolonged drought of recent decades, had not allowed the regeneration of pastures. Face to this problem no governmental aids had taken over pastoral administration. The insufficient sanitary coverage and the lack of veterinarians specialized in camel pathology are also recurring problems in the region. The production of camel meat and milk remains insufficient especially with the development of an increased demand for these products. Milk and meat are the pillar of sustainable development of the region and nomadic populations.

Keywords: *Camel breeding in Algeria, Climate and socio-cultural changes, milk and meat production*

NUTRITIONAL VALUE OF GRASSLAND MEADOW GRASS GRAZED BY DAIRY COWS BY USING PRIVALIM SOFTWARE

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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: 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 of the beginning 2nd cycle (grass 1) and the end of the 2nd cycle (grass 2) is 97g and 112 g respectively, and if the limiting factor is energy, the DPIE value is 96 g/kg DM and 103 g/kg DM.

Keywords: *grazed grass, chemical composition, energy value, nitrogen value.*

EFFECT OF *VARROA DESTRUCTOR* ON THE HIND WINGS AND ON THE HEMOLYMPHATIC PROTEINS AND CARBOHYDRATES OF THE WORKER HONEYBEE (*APIS MELLIFERA INTERMISSA*).

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Abstract

Varroa destructor (Anderson) (Acari: Varroidae) is an ectoparasite of the honey bee (*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 proteins and carbohydrates of the worker bee. 9 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.

Keywords: *Apis mellifera intermissa*, *Varroa destructor*, *morphometry*, *Hind wing*; *hemolymphatic metabolites*.

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 disinfected 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 seven 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.

Key words: *Apis mellifera* L, *Varroa destructor*, bacterial ectomicroflora, beehive summer debris.

CORPUS LUTEUM DIAMETER AND PLASMA PROGESTERONE CONCENTRATION DURING THE ESTROUS CYCLE IN ALGERIAN COW

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Abstract

The objective of our study is to determine the evolution of corpus luteum diameter and plasma progesterone concentration in local Cheurfa cows during the estrous cycle. Fifteen days after ovulation synchronization by OvSynch treatment, the ovaries of the cows were examined daily by transrectal ultrasound until spontaneous ovulation was observed. The interovulatory cycles that occurred after this spontaneous ovulation were used to determine the evolution of the size of the corpus luteum, measured by its mean diameter. The functional activity of the corpus luteum was evaluated by the plasma concentration of progesterone determined at each ultrasound examination of the ovaries by the radioimmunoassay. The results obtained show that the duration of the mean interovulatory interval was 20.5 ± 0.6 days. During the estrous cycle, the evolution of the size of the corpus luteum is characterized by a gradual increase from D2 to D6, then a plateau phase between D6 and D13, followed by a slow decrease until the next ovulation. The plasma progesterone concentration increased continuously from D0 (0.53 ± 0.1 ng/ml) until D14 (8.97 ± 1.5 ng/ml), then rapidly decreased below 1ng/ml two days before subsequent ovulation. A significant correlation exists between the corpus luteum diameter and the plasma progesterone concentration during the growth ($r=0.66$; $p<0.0001$) and regression phase of the corpus luteum ($r=0.65$; $p<0.0001$). In conclusion, the evolution profile of the corpus luteum diameter and plasma progesterone concentration was similar to that observed in other cattle breeds. Therefore, the corpus luteum size can be used as an indicator of its functional status.

Keywords: *Ultrasound, corpus luteum, plasma progesterone, estrous cycle, cow.*

MODALITIES OF ANTIBIOTIC USE IN POULTRY FARMING: SURVEY IN THE CENTER OF ALGERIA

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Abstract

Antibiotics are indispensable tools for the treatment of bacterial infections in both human and veterinary medicine. However, we must individually and collectively justify our treatment choices in order to preserve the effectiveness of the molecules as long as possible. The objective of our work is to get information on the practices of antibiotic therapy in poultry farming and to appreciate the importance of therapeutic failures encountered in current practice. A field survey had been carried out by means of a questionnaire, among 39 private veterinarians in the Wilaya of Boumerdes and Ain Defla, who ensure the follow-ups of poultry farms, and describe their practices towards antibiotics. The survey revealed a very frequent use of antibiotics in animal husbandry, both for prophylactic and curative purposes. The results also showed that the majority of surveyed veterinarians (75%), prescribed antibiotics without going through the laboratory diagnosis, which obliged them to follow only the clinical aspect to formulate their diagnosis, followed by a probabilistic antibiotic therapy, an approach that was not without consequence, indiscriminating use of these molecules, in general, resulting in destruction of the ecological barriers and selection of resistant strains. Also, the respondents said that they were confronted with the problem of therapeutic failures, and that antibiotic resistance was the most suspected cause. The investigation revealed a remarkable lack of control over the use of antibiotics, from the choice of active molecules to their administration to animals. The promotion of good antibiotic therapy practices is more than ever necessary in order to limit the selection of resistant bacteria, to preserve the effectiveness of the antibiotic drug, but also to limit the presence of drug residues in food of animal origin.

Keywords: *Antibiotic resistance, Antibiotic therapy, Poultry farming, Survey, Therapeutic failures.*

STUDY OF THE IMPACT OF HATCHERY VACCINATION AGAINST GUMBORO DISEASE ON ZOOTECHNICAL AND SEROLOGICAL PERFORMANCE IN BROILER CHICKEN IN ALGERIA

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Abstract

Gumboro disease represents a threat to poultry farms, particularly in broiler chickens. It causes immunosuppression leading to considerable economic losses. Vaccine protection depends on maternal antibody titers, hence the need to know the immune status of chicks at day 0. In this context we set ourselves the objective of comparing two methods of vaccination against infectious bursal disease in broiler chickens by the study of zootechnical and serological performances. Sixteen thousand (16000) 1-day-old chicks of ISA HUBBARD strain from the same hatchery are divided into two groups: a batch Vaccinated with an immune complex vaccine at the hatchery (Vc), and a batch vaccinated with an intermediate vaccine at the farm building (Vb). The two batches are homogeneous in terms of birth weight. Each batch contains 8000 chicks. Blood samples were taken at day 0, 14, 28, 35 for serological analysis by ELISA techniques. In our experimental conditions, the hatchery vaccination reduced the mortality rate by 4%, significantly modified the average live weight of the chickens at 49 days of age ($2007\text{g} \pm 37\text{g}$ against $1790 \pm 24\text{g}$ for the vaccinated in the building $P < 0.05$). Similarly, the hatchery-vaccinated batch significantly reduced feed consumption (-4%, $P < 0.05$) and consequently the consumption index was significantly reduced (-3%, $P < 0, 05$). The serological analysis confirms the presence of protective antibody levels of the vaccinated batch at the hatchery compared to the vaccinated batch at the breeding building. The serological analysis confirms the presence of protective antibody levels at the level of the vaccinated batch at the hatchery compared to the vaccinated batch at the level of the breeding building. Our results reveal a definite impact of the hatchery vaccination with an immune complex vaccine on zootechnical and serological performances.

Keywords: *Broiler chickens, Gumboro, Immune complex, Vaccination.*

MICROBIOLOGICAL CONTAMINATION OF THE RAW MILK COLLECTION CIRCUIT IN THE MITIDJA

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Abstract

The milk collection and transport sector is a strong link in the milk production chain. It is a major source of contamination accentuated by the lack of hygienic conditions throughout the chain. The objective of our work is to study the contamination of the circuit of the collection of raw milk in the region of Mitidja. A total of 98 samples were taken (raw milk (n=12), rinsing water (n=12), process water (n=2)). The bacteriological analyses performed were those recommended by Decree No. 35 of the JORA (Official Gazette of the Algerian Republic) of 27 May 1998. The bacteriological analysis of the collected raw milk revealed very high microbial contamination rates of $6.1 \pm 1.1 \text{ Log}_{10} \text{ (cfu/ml)}$ for total flora and $3.1 \pm 1.1 \text{ Log}_{10} \text{ (CFU/ml)}$ for thermotolerant coliforms, with a significant difference ($P < 0.01$) compared to the acceptability thresholds described by the national legislation. The analysis of the rinsing water of 12 tanks to assess the hygiene status of the surfaces showed that the contamination rate by total flora and thermo-tolerant coliforms is below the proposed limits. Statistical tests show a very highly significant difference ($P < 0.001$), despite the poor hygiene practices practiced by the collectors, leading us to believe that this rinsing method and these limits should be reviewed.

Key words: *Raw milk, collection tank, transportation, hygiene.*

BORDER DISEASE VIRUS AND OTHER PESTIVIRUSES IN SHEEP IN ALGERIA

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Abstract

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. 56 flocks from nine departments were visited and 689 blood samples were collected from adult sheep between 6 and 24 months of age and from lambs younger than 6 months. 576 serum samples were tested by Ab ELISA, to detect specific antibodies against Pestivirus and 197 of them were further characterized by VNT (virus neutralization test) for the detection of BDV, BVDV-1 and BVDV-2 specific neutralizing antibodies. 144/197 sera were positive in VNT for BDV, and 2 sera were strongly positive BVDV-2. All samples were tested by RT-PCR for detecting RNA virus as well as by Ag ELISA, but no Persistently Infected (PI) animals were found. Fifty-five flocks (98 %) had at least one positive animal and the apparent within-flock seroprevalence was estimated to be 60.17% (95% C.I.: 52.96-66.96). The true prevalence based on sensitivity and specificity of the 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 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 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.*

OVARIAN MORPHOMETRIC AND HISTOLOGICAL CHANGES DURING THE ESTRUS CYCLE IN COWS

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Abstract

The aims of our work was to study the morphometric and histological changes of the ovaries during the different stages of the oestrus cycle in cows. The experiment was carried out on genital apparatus recolted from slaughterhouses. The determination of the estrus cycle stages was based on the presence and size of ovarian structures. The results of morphometric changes show that : 1/ the difference in ovarian weight in favour of the right ovary was statistically non significant (13.48%) ; however, the difference in ovarian weight with or without corpus luteum was statistically significant (29.79%) and it was in favour for the ovary with corpus luteum. 2/ the difference in ovarian weight between the metestrus ($11.7 \pm 4.33\text{g}$), dioestrus ($13.0 \pm 1.27\text{g}$) and proestrus ($14.2 \pm 3.15\text{g}$) stage was statistically non significant. 3/ the corpus luteum was localized in 61.5% of cases in the right ovary. Histological analysis has shown that the tissue organization of the yellow body varies with the stage of the oestral cycle. In metoestrus, the number of small luteal cells is greater than in large luteal cells, whereas in dioestrus, the number of large luteal cells was higher. At the proestrus, the corpus luteum in regression was characterized by a cellular disorganization resulting in larger interstitial spaces, a decrease in the number of luteal cells and an increase in fibroblasts between luteal cells and in the septa of the connective tissue. In conclusion, the most important morpho-histological changes were observed more frequently on the right ovary. After ovulation, the high functional activity of the corpus luteum in the dioestrus stage was revealed by the presence of a high number of large luteal cells.

Keywords: *Ovary, Morphometry, Histology, Estrus cycle, Cows.*

LITTER SIZE COMPONENT TRAITS IN TWO ALGERIAN RABBIT LINES

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Abstract

The aim of this study was to estimate the limiting litter size components in rabbit females from a Synthetic line (n=32) and a Local population (n=34). Ovulation rate, number of implanted and live embryos were counted by laparoscopy at 12 d after mating. Prolificacy (total newborn, number born alive and mortality) and embryonic, foetal and prenatal survival at day of birth of the 3rd gestation were measured. The analysed traits were body weight of the female at mating, ovulation rate, implanted, live and resorbed embryos, embryonic, foetal and prenatal survival, as well as total newborn, number born alive and mortality at birth. Synthetic line females had a higher ovulation rate compared to the Local population (11.03 ± 0.23 vs. 8.41 ± 0.23 corpora lutea; $P < 0.0001$). Synthetic line displayed a higher number of implanted embryos (10.00 ± 0.25 vs. 7.85 ± 0.25 embryos; $P < 0.0001$). No difference was found between groups for number of resorbed embryos. Similar embryonic, foetal and prenatal survival rates were reported between the Synthetic line and the Local population. Additionally, total newborn was higher in the Synthetic line than in the Local population ($+1.46$ kits; $P < 0.05$). A principal components analysis was performed. The first four principal components (PC) explained more than 90% of the total variation in both lines. Total newborn, number born alive and live embryos were the main variables defining the 1st PC. Resorbed embryos and foetal survival were located in the 2nd PC. Ovulation rate and embryonic survival were the predominant variables defining the 3rd PC. The body weight of females was located in the 4th PC. The phenotypic correlation between total newborn and its components were high and positive in both lines, except for ovulation rate and total newborn, where it was moderate in Synthetic line. In conclusion, the females from Synthetic line have a higher total newborn than those from Local population, as a consequence of a higher number of released oocytes and embryos that successfully reach implantation. However, a higher uterine crowding in Synthetic line seems to limit survival of foetuses that reach term of gestation, while ovulation rate is the principal limiting factor of total newborn in Local population

Key Words: *crossbreeding, litter size, ovulation, prenatal survival, rabbits*

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 *Cryptosporidium 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*

SYNTHETIC RABBITS LINE: GENETIC CORRELATIONS FOR REPRODUCTIVE AND GROWTH TRAITS

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Abstract

The objective of this study was to obtain heritability estimates for reproductive (litter size at birth, number born alive, litter size at weaning) and growth traits (individual weaning weight, individual weight at the end of the fattening period), then determine the genetic correlation between them in a synthetic rabbit line. A total of 805 females, 3242 parities, and 18 472 growth records were measured from 2006 to 2017. A pentavariate 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. These traits showed a large coefficient of variation (from 32% to 56% for reproductive traits and from 21% to 28% 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 traits were high and negative, especially with weight at weaning (-0.848, -0.922, and -0.854 for litter size at birth, number born alive, and litter size at weaning, respectively). In conclusion, because of the high negative correlation between reproductive and growth traits, both reproductive and growth traits should be selected in independent lines and the response to selection should be due mainly to the high coefficient of variation of the traits.

Keywords: *genetic correlation, heritability, litter size, weaning weight, rabbits.*

EVALUATION OF VACCINE PROTECTION AGAINST NEWCASTLE DISEASE IN POULTRY

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Abstract

Newcastle disease is an infectious disease, highly contagious, affecting all birds and particularly gallinaceans, caused by any avian strain of paramyxovirus type 1 (PMV1) of the Paramyxoviridae family. Due to its importance and high contagiousness, Newcastle disease is the subject of a national sanitary and medical prophylaxis plan. But, despite vaccination, Newcastle disease still continues to occur in poultry farms. The reasons for these vaccination failures are not well known. To evaluate the protection conferred by the vaccination programs applied against Newcastle disease, a titration of antibodies against APMV1 was carried out by the Haemagglutination inhibition method (HIA test) in four (04) broiler farms. The results obtained gave a farm that was not correctly vaccinated, with an antibody titer of 1/8, a titer that is lower than the positive threshold (1/16). Also, the immune response in farms where the antibody titer is considered satisfactory depends on the vaccine used and its route of inoculation, the vaccination program followed, and environmental and individual factors. Furthermore, because serology alone does not explain the level of protection induced by vaccination, research is currently being conducted in the laboratory to further measure the cell-mediated immunity and local immune response (in the respiratory and digestive tract) specific to Newcastle Disease Virus (NDV) and their role in protection against clinical signs and virus shedding.

Keywords: *Broiler, HIA test, Newcastle disease, Prophylaxis, Vaccination.*

COAT COLOR AS INDICATOR OF FERTILITY IN DAIRY COWS IN ALGERIA

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Abstract

The aim of our experiment was to estimate the correlation between the reproduction parameters of 48 dairy cows (29 Montbeliardes and 19 Normandes) and the percentage of the white coat color. Cows were imported from European countries and raised in the semi-arid region of Sétif in Algeria. Fertility parameters were estimated: the number of services per conception (SPC), calving to first service interval (FSI), calving to conception interval (CI), and the interval between calving (ICC). The percentage of white color of coat has been measured visually (C %). Statistical analysis was carried using Pearson correlation and Spearman's correlation rank when variables were not normally distributed with the SPSS package program, version 21. In Montbeliarde breed, C% was significantly correlated with ICC ($r = 0.543$, $p=0.002$) indicating that Montbéliarde cows, with high percentages of white color achieve longer ICC. In Normande cows, coat color was negatively correlated with FSI ($r = -0.565$, $p = 0.012$), cows with high percentages of white color return to heat sooner after calving. The results of the current study suggest the possibility of integrating coat color into animal selection. It can be assumed that colored coats for Montbeliarde and Normande breeds appear to be related to their reproductive efficiency (interval between calving and calving to first service interval respectively).

Keywords: *Coat color, Dairy cows, Reproduction, Algeria.*

MORPHOMETRIC CHARACTERISTICS OF LUCIOBARBUS MASCARENSIS AND L. LANIGARENSIS (TELEOSTEI: CYPRINIDAE) IN WESTERN ALGERIA

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Abstract

A total of 81 samples captured between November 2017 to September 2019 were morphometrically analyzed as part of this study. In this latter we tried to compare between the population of the dam (artificial environment) and the population of the river (natural environment) in two watersheds for two different species of *Luciobarbus* in western Algeria. Sites A (natural) and B (artificial) are located at almost the same altitude (285-571 m) whereas sites C (artificial) and D (natural) are located in two different altitudes (285-571 m) and (1078-1821 m) respectively. The analysis of variance (ANOVA) was carried out to test the significance of the variations of each morphometric character between the 4 populations (A, B, C and D). The values of all the external morphometric parameters were the highest in the population of the Boughrara dam followed by El-hammam river and Bouhanifia dam while the population of Chouly river showed the lowest morphometric measurements. The mean of total length (TL) and weight (Weight), for example, of the Boughrara dam were the largest of the four populations (33.03 ± 2.02 cm and 474.46 ± 116.76 g respectively) while those of the river Chouly were the smallest (15.44 ± 1.23 cm and 55.55 ± 13.01 respectively). The sex ratio analysis was performed by studying the overall sex ratio. Females were more abundant than males (1: 1.7). The graphical representation of Quantitative Variables by PCA showed that the morphometric variables are all positively correlated with each other by quite different rates. The Shannon and Weaver index was calculated from the different characters in the four regions studied: A, B, C and D. The region of site B (Bouhanifia dam) had the highest average diversity index with 0.92, followed by the region of site A (El-hammam river) (0.88). The lowest mean value was found in site C (Chouly river) (0.29).

Keywords: *Luciobarbus mascarensis*, *L. lanigarensis*, morphometric measurements, West Algeria.

HISTOMORPHOMETRIC CHANGES OF TESTIS STRUCTURE IN RELATION WITH ANOGENITAL DISTANCE AND SEXUAL EXHAUSTION OF ALGERIAN POPULATION RABBIT BUCK

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Abstract

The aim of this study was to follow up the histomorphometric changes in rabbit testis following sexual exhaustion in relation with anogenital distance (AGD). A total of 10 rabbit local population, nine months old and weight ranging between 3.000 kg and 3.700 kg were tested with females sexually receptive. The pair was allowed to copulate freely until the male showed no further sexual interest. This procedure was repeated daily until the male showed no sexual behavior. Observations on animals initially focused on the measurement of AGD, study of the different parameters of the sexual behaviour and the histomorphometric characteristics of rabbit testis. The mean AGD in the bucks used in our experiments was 14.65 ± 1.92 mm. 60% of the bucks had greater AGD than the mean AGD, whereas 40% had lower AGD than the mean AGD. The results showed that the bucks eventually stopped copulating after a variable number of days (range: 2-10 d) and the AGD influenced at least some reproductive parameters. The male rabbits with the large AGD had a larger weight, marked more their territory (30.02 ± 17.07), overlap and protrude more females, they resisted more and they reached exhaustion late. However, rabbits with the small AGD had a smaller weight, scoreless (20.40 ± 13.67), overlap less, projected less and had a rapid exhaustion. Histomorphometric study of testicular structures indicates a relationship between AGD and testicular structures (surface, thickness of epithelium and light of seminiferous tubes, number of sertoli cells). These parameters help our rabbit breeders to select breeding rabbits.

Keywords: *Rabbit, Sexual behavior AGD, Histomorphometric.*

PREVALENCE OF DIGESTIVE CARRIAGE OF *E.FAECALIS* AND *E.FAECIUM* SPECIES IN BROILER AND CHARACTERIZATION OF THEIR ANTIMICROBIAL RESISTANCE PROFILE

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Abstract

Enterococci are natural hosts of the digestive tract of humans and animals. The two main species responsible for infections in humans are *Enterococcus faecalis* and *Enterococcus faecium*. Today, three elements lead to a renewed interest in enterococci, namely the increasing number of their isolation during various infections, the importance of their place in nosocomial pathology and the emergence and accumulation of antibiotic resistance mechanisms. The objective of our study is to evaluate the digestive carriage of two species of enterococci: *E.faecalis* and *E.faecium* in broilers, and to study the resistance of isolates to different families of antibiotics, in particular to Glycopeptides. The two species of enterococci were identified with conventional methods based on morphological and biochemical characters, and the isolates were tested for antibiotic susceptibility by the Kirby Bauer agar diffusion method and a panel of 10 antibiotics was tested. The study of the digestive carriage of enterococcal species in broilers showed the predominance of *E.faecalis* (60%), followed by *E.faecium* (40%). High percentages of resistance to Tetracycline and Erythromycin were observed (88% and 61% respectively), low levels of resistance to Ciprofloxacin and Penicillins, with rates of 04% and 03% respectively. Resistance to high concentrations of Streptomycin was recorded (05%). However, all strains were sensitive to Vancomycin, Ampicillin, high level Gentamycin, Nitrofurantoines and Chloramphenicol. The most frequent antibiotic resistances detected in our study are to antibiotics widely used in livestock (Tetracyclines and Macrolides). Vancomycin resistance was not detected in our study, but some of the reported resistances (resistance to high levels of Aminoglycosides and Penicillins), if spread in the food chain, would have public health implications.

Keywords: Antibiotic resistance, Broiler, Digestive carriage, *E.faecalis*, *E. faecium*.

THE ASSOCIATIVE INVASIONS AND THEIR LIQUIDATION OF THE SMALL RUMINANTS IN SHIRVAN-SALYAN ECONOMIC REGIONS OF AZERBAIJAN

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Abstract

The research was carried out with the purpose of learning the helminth fauna of the small ruminants kept in the Shirvan-Salyan economic regions (Neftchala, Bilasuvar, Salyan, Hajigabul, Shirvan) of Azerbaijan. As a result of the research, the taxonomic research of the helminth fauna of the small ruminants was carried out, and the systematics of the species was compiled. The helminth fauna of the sheep and goats - the helminths included 32 species and 3 species of the trematodes. The 3 species of the trematodes – *Fasciola hepatica*, *Dicrocoelium lanceatum*, *Paramphistomum cervi* belonging to the trematodes class formed the helminth fauna of the small ruminants. The pathogens caused the nematodoses in the animals were the species belonging to the genera *Trichostrongylus*, *Chabertia*, *Oesophagostomum*, *Nematodirus*, *Ostertagia*, *Haemonchus*, *Marshallagia*, *Cooperia*, *Bunostomum*, *Dictyocaulus*, *Protostrongylus*. The fasciolosis, dichroeliosis, paramphistomatosis formed by detected 3 species trematodes were noted with high intensity in all the landscapes. In the small ruminants the infection with the nematodes and trematodes was noted with the associative forms in the spring, summer and autumn seasons. For the purpose of deworming 3 anthelmintic preparations 22.2% *Fenbendazole*, *Alvet* and *Levamin* preparations and a mixture of wormwood were tested against the helminthiasis. During the experiment toxicity symptoms were not observed either in the experimental or control animals. A mixture of closant and wormwood has been shown to be highly effective against nematodes and trematodes. It is considered expedient to apply the mixture on farms.

Keywords: *Small ruminants, wormwood, anthelmintic effectiveness, associative invasions, helminthiasis, pathogenic species.*

INFLUENCE OF ENVIRONMENTAL FACTORS ON SOME SERUM BIOCHEMICAL PARAMETERS IN SHEEP

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Abstract

Sheep play a significant role in the Bosnian and Herzegovinian agricultural economy, particularly in mountain areas, where most are kept by the smallholder production systems. This study includes differences in values of some biochemical parameters of sheep who inhabit the Livno area and mount Vlašić of Bosnia and Herzegovina. The serum levels of total protein, albumin, globulin, urea, creatinine, glucose, aspartate aminotransferase, γ -glutamyl transferase, creatine kinase and cholesterol were determined. All analyzes were using the spectrophotometric method. Non-esterified fatty acids and β -hydroxybutyrate levels in serum were measured by Randox kit (UK). Significant differences of some serum biochemical parameters between the two areas have shown the impact of environmental factors on the sheep's metabolic status. Obtained results of β -hydroxybutyric acid, total protein, albumin, urea, aspartate aminotransferase and cholesterol were significantly decreased in the Livno area, while non-esterified fatty acids, creatinine and glucose were increased. Almost all biochemical parameters showed variations between the sampling areas, which could be caused by the influence of different climate and altitude areas.

Keywords: *sheep, biochemical parameters, blood.*

QUALITY OF RAM SPERM AS A CONDITION FOR SUCCESSFUL CONCEPTION OF SHEEP, DURING MATING SEASON AND LATE ANESTRUS SEASON

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Abstract

The area of Una-Sana Canton is a hilly area with an average altitude of around 350 m, with numerous and high quality pastures. Sheep are seasonally polyestrous animals whose reproduction is clearly biologically regulated. Seasonally reproductive activity of rams, in terms of production intensity and quality of sperm (its degree of fertilizing ability), and the intensity of sexual libido is not as strongly influenced by annual season as is the case with sheep. The aim of this paper was to examine the quality of the sperm in rams as a condition of successful conception of sheep during the periods of late anestrus (April-May) and mating season (from mid-September to mid-October). All parameters that determine fertilization capacity of ejaculate, and which are more or less related to its fertility will be examined. Our research involved 30 fully mature rams of the Pramenka breed (strain: Travnik Pramenka), with strong libido, in good health and condition. The research was conducted in three municipalities in north-western part of Bosnia and Herzegovina (Bihać, Cazin and Sanski Most), by 10 rams from each. We can conclude that the quality of ram sperm has the key importance in successful conception of sheep, as the results of examined parameters shows lower values in late anestrus than in mating season

Keywords: *Mating season, Pramenka sheep, Ram sperm.*

EXTERIOR MEASURES AND WOOL QUALITY IN SHEEP BREEDED IN THREE LOCATIONS IN BOSNIA AND HERZEGOVINA

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Abstract

The aim of this study was to measure the basic external characteristics of Pramenka sheep: height at withers, the crosses, carcass length, chest width, chest depth, chest circumference, breast circumference carcass, shin circumference and body weight, as well as to determine the basic parameters of wool quality: strand length, fine fiber fineness, strength, twisting ability, tensile strength, in order to compare the measured values to assess the impact of growing areas on them. Domestic autochthonous strains of Pramenka (Kupres, Travnik) were used for research. There were 36 sheep in the group animals. Measurements were performed on long-term purebred herds of Pramenka on three private farms in the Una-Sana Canton, Cazin, in Central Bosnian Canton, Travnik, and Kupres, Livno Canton. Based on the presented average values of external characteristics of Pramenka sheep and their variations for all examined localities, we can conclude the following: that sheep are longer in relation to their height and that Pramenka is of medium physical development, that differences in physical measures in and the origin of certain breeds-strains of sheep of the Pramenka breed (Kupres strain, Vlašić strain), as well as the quality of pasture areas and unequal access to food. The measured parameters of wool quality indicate that the quality of wool, in almost all examined parameters, is poor, regardless of the location of sheep breeding. Comparing our results with the results of other authors who examined the exterior of other strains of Pramenka (from region in Croatia: Rab, Lika, Pag, Istria) in our wider environment, we conclude that Vlašić Pramenka is the largest strain of Pramenka in this area.

Keywords: *Sheep, External traits, Quality, Wool.*

THE EFFECT OF RIPENING TEMPERATURE ON PROTEIN PROFILES OF KAJMAK

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Abstract

Kajmak is dairy product mainly composed of milk fat aggregates and proteins. Protein fraction of Kajmak is generally composed of caseins, whey proteins, milk-fat globule membrane proteins (MFGM) and other minor proteins of milk. Their content and composition depend on numerous factors including type and quality of milk and processing conditions, especially on regime of heat-treatment of milk and probably of ripening conditions. In this work we investigated the effect of different temperatures (4°C and 16°C) on protein profiles of Kajmak ripened for up to 28 days. The change of protein profiles during storage of Kajmak at different temperatures was followed using SDS-PAGE under reducing conditions and densitometric analysis. In general, relatively slow proteolysis occurred during ripening of Kajmak. However, the choice of ripening temperature affected the distribution of the major proteins and polypeptides. The ripening at 16°C induced more intensive degradation of the major casein fraction than the ripening at 4°C. Ripening of Kajmak at 16°C reduced the relative content of all of three identified caseins but to the different extent. The most susceptible was κ -CN; this casein was completely hydrolyzed between 7th and 14th day of ripening. Also, β -CN was more prone to hydrolysis than α_s -CN. In opposite to the ripening at 16°C no significant ($p < 0.05$) changes between relative contents of α -CN of 7-days-old and 28-days-old samples ripened at 4°C were detected whereas the ratio of β -CN after 28 days at 4°C decreased from 25.81% to 22.87%.

Key words: *Kajmak, Ripening Protein profiles.*

CRYOPRESERVATION OF HONEY BEE DRONE SPERMATOZOA

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Abstract

The mass extinction of Honey bee (*Apis mellifera*) colonies in the recent years is a problem not only for beekeepers but also for the entire agricultural sector. Bees are the main pollinators of nearly 70% of the plant crops that feed humanity, but also of a number of wild plant species. The Colony Collapse Disorder is a phenomenon that occurs when the most of the worker bees in the hive disappear, leaving behind a queen, plenty of gathered food, and a few nurse bees that take care for the remaining larvae. In order to preserve the genetic diversity of the species and its varieties it is of great interest the establishment of protocols and media for low-temperature storage of drone semen. Significant difficulties in cryopreservation arise as a result of the small volume of the ejaculates, differences between the subspecies and cytotoxicity of a number of widely used cryoprotectants. This study compares the effects of glycerin and dimethyl sulfoxide in the process of cryopreservation of drone spermatozoa from *Apis mellifera macedonica*. The evaluation of sperm motility, vigor and kinetics before and after thawing was performed using Sperm Class Analyzer. The experiments demonstrated that 12 % dimethyl sulfoxide preserve post-thaw cell motility and kinetics compared to the medium with 9 % glycerin. However, extensive research is needed, to improve drone sperm quality after thawing and implementation of other substances in honey bee cryopreservation and artificial insemination.

Keywords: *bee drones, spermatozoa, cryoprotectants*

A STUDY OF SOME MODERN CARE METHODS TO AVOID THE CALF MORTALITY UNDER THE INTENSIVE CARE SYSTEM

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Abstract

The objective of this study was to examine the existing challenges and opportunities of traditional camel calf management practices. The importance of camels as a source of livelihood. This experiment was carried out at studies and development camel center in Matrouh, Egypt. Twenty adult pregnancy dromedary camels at final month before parturition were used to avoid the calf mortality under the intensive care system. The primary and secondary data were collected to assess the impact of improved camel calf management and information whose dissemination was underway on the productivity of camel calve. The aim of the study was to identify and assess the major factors in order to formulate guidelines for control strategies for improved performance. s. the pregnancy camel's PC were divided into two groups (each group contains 10 PC). A food plan has been developed for the experimental pregnancy camels which is different from the control (pregnancy camel) a month before birth, in order to give calves good health. calf's mortality rate of new born was 95%than control 80%. Growth rate was significantly increase ($p < 0.05$) with control group. In the other hand, the percentage of case of death camel calves was disease diarrhea 5% than control 10% Under the new care systems of the experiment group than in the control group. This study concluded that the existing indigenous camel calf and information on camel calf management have great potential to improve camel calf performance.

Keyword: *dromedary camels, calves' mortality, growth rate, diarrhea*

CHALLENGES FACING A PLATFORM FOR LINKING SMALL MILK PRODUCERS (SMPS) WITH MARKETS IN TWO VILLAGES IN THE NILE VALLEY OF EGYPT

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Abstract

(SMPs) in Egypt are currently suffering from the absence of public Extension and Advisory Services (EASs) due to the ever-decreasing numbers of Village Extension Workers (VEWs) and ever-declining Governmental funding. New arrangements need to be initiated for effective provision of these services. Contract-based agreements, involving different stake holders, represent an appropriate platform for linking SMPs with local market through providing them with their needed and demanded EASs. This study aimed to investigate the challenges facing a platform established for linking SMPs with markets in the Nile Valley of Egypt. The study was conducted in two villages in Beni- Suef Governorate, the Nile Valley, 145 Kms from Cairo. A questionnaire, through personal interviews, was used for collecting data from a random sample of 26 females and 81 males, involved in a platform established for providing SMPs with needed knowledge and skills for improving the quantity and quality of their production. In addition to the SMPs involved, as members in members of 2 Non-Governmental Organizations (NGOs), this platform included a private milk marketing company, dairy production experts from the public and private sectors. Frequencies and percentages were used for data presentation and analysis. Results revealed several financial, marketing and production challenges that face the platform. The respondents' suggested recommendations to face these challenges include: increasing prices of SMPs' products; securing timely provision of subsidized inputs, enhancing all partners' accountability, attracting more milk processing companies to join the platform; and providing SMPs with quotas of production inputs on credit through their NGOs.

Keywords: Challenges, Extension and Advisory Services, Platform, Small Milk Producers, Nile Valley, Egypt.

GROWTH PERFORMANCE AND CARCASS CHARACTERISTICS OF SASSO T44 AND KOEKOEK CHICKS EXPOSED TO TEMPERATURE VARIATION WITH SUPPLEMENTARY CORIANDER SEED POWDER

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Abstract

The aim of the present study was to evaluate the effects of ambient temperature and coriander seed supplementations in Sasso T44 and Koekoek on their growth performance, carcass characteristics and internal organs weights. In the experiment, both breeds were exposed to two temperatures rooms (heated rooms $32 \pm 1.2^{\circ}\text{C}$ from 11:00 to 16:00 and the normal room temperature of average maximum and minimum of $23.8 \pm 3^{\circ}\text{C}$ and $16.6 \pm 1.6^{\circ}\text{C}$, respectively) with relative humidity between 34.5 ± 4 to $44.8 \pm 3\%$. The experiment was conducted from 10 to 20 weeks of age. Both breeds were received 0 g/kg, 5 g/kg and 10 g/kg of coriander seed supplementations. The results indicated that the breed effect was rather influenced more on growth performance, carcass characteristics and internal organ weights. Accordingly, Sasso T44 had higher feed intake, body weight, and consequently higher water intake, weight gains, carcass characteristics and internal organs. In both breeds males were heavier ($P < 0.001$) than their female counterparts. Water intake was 2.5% higher in the groups exposed to a heated room than those exposed to a normal (unheated) room. Similarly, the interaction of temperature, breed and age in weeks showed slightly lower ($P < 0.05$) feed intake in Koekoek placed in a heated room at the age of week 16. Moreover, temperature had an effect on body weight gain, and breed groups reared in heated room had slightly lower weight gain (by 1.4%) than those placed in normal room. Moreover, groups exposed to a heated room had 8.5% lower liver weight than the groups placed under normal room. The interaction of coriander seed supplementation and temperature showed a higher mean body weight ($P < 0.05$) in the groups placed in a normal room fed with the treatment containing 10g/kg of supplementary coriander. Furthermore, the groups fed 5-10 g/kg of supplementary coriander in a heated room achieved comparable body weight to the groups fed with 0-5g/kg coriander in a normal (unheated) room. At an age of 16 to 20 weeks, Koekoek exposed to heated room with supplementary coriander seed powder had significantly ($P < 0.05$) higher live weight than the non supplemented groups. The interaction of coriander seed and breed also showed higher breast weight in Koekoek supplemented with 10g/kg of coriander seed. It can be concluded that, breeds subjected to heated room impaired some of the growth and carcass performance parameters, while, coriander seed supplementation enhances performances and the 10g/kg coriander seed powder supplementations had a positive effects potential on body weight of Koekoek exposed to heated room.

Keyword: *body weight, feed intake, heated room, internal organs, normal room, water intake*

EFFECTS OF FEEDING DRY OLIVE CAKE ON MILK PRODUCTION AND ON FERTILITY PARAMETERS IN HOLSTEIN COWS

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Abstract

Here we examined the effects of inclusion of dry olive cake (DOC) on dairy cows' production and fertility. The experiment started 21±5 days prepartum and lasted until day 120 postpartum. The control ration (group C, n=30) was the conventional farm's ration, while group T (n=30) was fed a modified ration containing 1kg/cow of DOC; the rations were isoenergetic and isonitrogenous. Milk yield was automatically recorded, and milk samples were analyzed for fat, protein, CFU and SCC contents. From calving to day 42 postpartum all animals were examined weekly, and any health disorder was recorded and treated. Blood samples were analyzed for: BHBA every week, acute phase proteins (APP, Haptoglobin-Hpt and Serum amyloid -SAA) on days -7, 7 and 21 (calving, day 0) and progesterone 7-8 days after estrus. For the first 56 days of lactation, no difference was detected between groups in mean milk yield, fat, and CFU. Mean protein tended (p=0.07) to be lower in treated (3.32±0.19) than in control animals (3.41±0.13). Mean SCC in group T was lower (p<0.03) than in group C. On day 7 BHBA levels were lower (p<0.05) in group T than in group C. On day 42 more group T animals 23/30 (p=0.002) were found endometritis-free compared to group C (15/30). At all time points both APPs were lower (P<0.05) in group T compared to group C, while no difference was found in progesterone. In group T cows, the calving to first estrus interval (40.7±14.8days) was shorter (p<0.05) than in group C (57.4±14.1 days). Finally, by day 120, more (p=0.07) group T (15/30) than group C (8/21) cows were pregnant. Our results imply that DOC is a safe feedstuff that does not affect milk yield, reduces the SCC and enhances cows' fertility.

Keywords: *Dry olive cake, haptoglobin, progesterone, somatic cell counts, cow,*

BROILER GROWTH RESPONSE AND BLOOD PARAMETERS AS INFLUENCED BY SUPPLEMENTAL EUGENOL AND BUTYRIC ACID

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Abstract

The aim of this study was to determine the effect of eugenol and butyric acid on broiler growth response and some blood parameters. A total of 300 one-day-old broiler chicks (Ross 308) were assigned into six groups with five replicates and 10 birds each by employing a completely randomized design with a factorial arrangement (2×3). Two levels of butyric acid (0 and 2%) and three levels of eugenol (0, 500 and 1000 mg/kg) were tested in a 42 days study. Feed intake and weight gain of birds were decreased by 1000 ppm eugenol compared with its other levels and by 2% butyric acid compared with 0% level ($P<0.05$). The birds on 0% butyric acid and 500 ppm eugenol showed the best weight gain and feed conversion ratio ($P<0.05$). However, those on 2% butyric acid and 1000 ppm eugenol showed the worst weight gain ($P<0.05$). Supplementation of 2% butyric acid reduced the concentration of total and LDL cholesterol, while increased HDL-cholesterol level of serum ($P<0.05$). Adding eugenol to the diet decreased the concentration of total and LDL cholesterol ($P<0.05$). All levels of the additives declined total cholesterol and LDL-cholesterol levels compared with no additive diet ($P<0.05$). The concentration of serum levels of triglyceride and VLDL-cholesterol were not affected by the treatments. In conclusion, no synergistic effect was observed between butyric acid and eugenol on broiler chicken growth performance and blood parameters. High levels of the additives had no beneficial effect on performance and blood parameters as well.

Keywords: *Eugenol, butyric acid, performance, Blood parameters.*

EFFECT OF POTATO BY-PRODUCT ON GROWTH RESPONSE AND DIGESTIVE FUNCTION OF BROILERS DURING DIFFERENT FEEDING PERIODS

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Abstract

Potato and its by-products, due to having high level of starch, can be partially replaced for corn in poultry rations. In this experiment, the effect of sliced potato by-product was studied on broiler chickens' growth performance and nutrients digestibility during different raising periods. A total of 256 one-day old Ross 308 broiler chicks were allocated into four dietary treatments with four replicates by employing a completely randomized design. The treatments including a control corn-based diet or 50% potato by-product replaced diet (fed during throughout, grower and finisher or only finisher periods) were fed to birds for 42 days. Feed intake and weight gain were measured periodically. The excreta samples were collected to determine nutrients digestibility following the consumption of chromium oxide diet at the end of the experiment. Replacing of 50% potato by-product reduced feed intake and weight gain in starter period (1-10 d), and lowered weight gain and increased feed conversion ratio in the grower (11-24 d), finisher (25-42 d) and whole raising periods ($P<0.05$). Potato by-product also reduced digestibility of organic matter and declined nitrogen retention in broilers ($P<0.05$). However, digestibility of dry matter, crude ash and crude fat was not affected by the treatments. In overall, consumption of 50% replaced sliced potato by-product instead of corn is not recommended in broilers diet due to reduced growth performance and decreased nutrients digestibility in none of the feeding periods.

Keywords: *Potato by-product, Performance, Digestibility, Broiler chicken.*

USE OF OLIVE, LAUREL AND ROSEMARY POWDER LEAVES IN FEEDING OF LAYING HENS

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Abstract

Oxidative stress is involved in a number of physiological processes in human biology and medicine as well as in several pathological disorders in farm animals. Antioxidants are efficient scavengers of free radicals neutralizing the negative effects and reducing oxidative stress. Several plant materials used in animal diet are sources of phenolic compounds, which are natural antioxidants to preserve and enhance oxidative status of animals and products quality. The study aimed to evaluate the effects of diet with inclusion of olive, laurel and rosemary leaves powder on metabolic profile and egg production in laying hens. A total of 100 laying hens were divided into two groups of dietary treatment: Control, received commercial feed; T-Group received commercial feed with inclusion of a mixture of powder leaves (olive+laurel+rosemary; 6 mg/kg feed). The trial lasted 60 days. In the last 3 days, 10 eggs per group were collected for the evaluation of the eggs quality. Blood samples were taken at the end of the experiment for the evaluation of the metabolic profile and oxidative state of the animals. The results showed that inclusion of olive, rosemary and laurel leaves in diet unaffected the production and qualitative characteristics of the eggs. The experimental diet decreased ($P<0.05$) the serum level of tryglicerides, increased ($P<0.01$) the concentration of HDL cholesterol, and improved the total oxidative status (TOS; $P<0.01$) and ROMs ($P<0.05$). No significant differences ($P>0.05$) were found in the NEFA concentration, proteic and hepatic profiles, and immunological profile (TNFalpha, IL-6, IL-1beta). These results provide insight into the effects of dietary leaves rich in polyphenols on oxidative status in laying hens.

Keywords: *Powder leaves, polyphenols, Feed, Oxidative status, Laying hens.*

PRODUCTION OF CHEESE FROM DONKEY MILK: MAY THE USE OF TRANSGLUTAMINASE IMPROVE THE CLOTTING ACTIVITY?

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Abstract

Donkey milk is characterised by poor clotting activity due to its low contents in caseins, specially k-casein, and fat that make very difficult the cheesemaking process compared to milks of conventional dairy species. The aim of this study was to assess the effects of two patterns of microbial transglutaminase addition to donkey milk, on milk acidification and on some cheesemaking parameters. Four cheesemaking small scale sessions using microbial transglutaminase (MTGase; 5.0 U/g milk protein) were performed in mini-vat heated by thermostatic water bath according to the following patterns: control (CC), no MTGase addition; MTG1, MTGase addition (40 °C) 15 min before starter inoculation; MTG2, MTGase addition simultaneously with rennet (42 °C) in acidified milk (pH 6.3). Milk acidification evolution following bacteria starter inoculation (*Streptococcus thermophilus*; 0.01 g/L milk), as time necessary to reach the value of pH 6.3, cheesemaking parameters, gel viscosity and cheese yield were recorded. The addition of MTGase together with rennet (MTG2) had fortification effect on donkey milk improving curd firmness in comparison with the CC, and the highest curd viscosity. In comparison with MTG1, MTG2 affected ($P < 0.01$) the slower acidification time and the shorter gel formation time. The cheese yields were 7.39% in control, 7.13% in MTG1 and 6.91% in MTG2. In conclusion, the use of MTGase simultaneously with the addition of rennet to donkey milk determined an improvement of curd formation and firming, with potential application for innovative dairy products and for the further development of donkey milk productive chain.

Keywords: *Donkey milk, Cheesemaking, Transglutaminase*

EXTRACTION, CHARACTERIZATION, AND EVALUATION THROUGH *IN VITRO* STUDIES OF THE ANTHELMINTIC EFFICACY OF PASTEUR PLANT SPECIES FOR BIOLOGICAL CONTROL OF SHEEP GASTROINTESTINAL NEMATODES (GIN)

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Abstract

GIN infection jeopardizes the health and welfare of livestock and is commonly associated with economic losses. Significant progress has been made in the biological control of GIN in ruminants due to the emergence of drug-resistant parasite populations, increased demand for organically produced products and legislation regulating and restricting the use of anthelmintic drugs. This study aimed to extract, characterize and evaluate the *in vitro* anthelmintic activity of extracts of 28 medicinal plants sampled on pastures in southern Italy. Extracts were obtained through maceration. All extracts were preliminarily characterized in their total phenolic content (TPC, Folin-Ciocalteu assay). Egg hatching test (EHT) was performed to estimate the *in vitro* anthelmintic efficacy of plant extracts using GIN eggs from sheep naturally infected with *Haemonchus contortus*, *Teladorsagia circumcincta* and *Trichostrongylus colubriformis* genera. Extracts that showed significant anthelmintic efficacy *in vitro* were characterized by UHPLC/UV-ESI-HRMS. All extracts showed significant TPC and were analyzed in three replicates with EHT at decreasing concentrations from 28.0 mg·mL⁻¹, 98.0 mg·mL⁻¹ and 40.0 mg·mL⁻¹, for aqueous, ethanolic and hydroalcoholic extracts respectively. In particular, *Borago officinalis* L. and *Malva sylvestris* L. extracts caused high inhibition of egg hatching within 48h after exposure, showing great efficacy (≥ 98%). Characterization of the extracts showed the presence of compounds in the class of tannins, flavonoids, glycosides, alkaloids, and terpenoids. Field application with *in vivo* studies would lead to confirm results obtained from *in vitro* tests, evaluating the therapeutic potential and future applicability with specific plant crops in pastures to achieve year-round "helminth-free" sheep flocks.

Keywords: *Gastrointestinal nematodes, Anthelmintic resistance, Phytotherapy, Polyphenols, In vitro test.*

RESEARCH ON LAYING HEN CROSS DOMINANT BIOLOGICAL EGG COMMERCIAL PRODUCTION USING VARIOUS TYPES OF FEED

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Abstract

The demand for ecologically-friendly food produce, including those of animal nature, e.g. hen eggs, is increasing continuously in Latvia as well as all across the world. Research objective is to determine the most productive and most suitable for Latvian environment laying hen crosses that can be kept for bio-egg commercial production, as well as to decide upon most suitable biologically produced and economically efficient feed for these hen crosses. The research was held in Kandava municipality, Kandava rural territory, “Kurzemes olas” Ltd. laying hen farmstead “Upkalnu ferma”. The research involved three Dominant laying hen crosses: Dominant Barred D 959, Dominant Tinted D 723 and Dominant Red Barred D 459. All in all, there were 6 groups, each of them consisting of 100 birds. One group of each hen cross was fed with manufactured complete bio-feed (group numbers D723K, D459K and D959K), while the second group – with home-made bio-feed designed for laying hens (group numbers D723S, D459S and D959S). The maximum results that were reached during the entire research period were as follows: D723K – 71% in September (26-29 weeks old), D723S – 82% October (30-34 weeks old), D459K – 56% November (35-38 weeks old), D459S – 58% October (30-34 weeks old), D959K – 54% November (35-38 weeks old) and D959S – 62% October (30-34 weeks old). The best productivity indicators on average were demonstrated by laying hen cross D723 ($p < 0.05$). The cross D459S produced eggs with higher average weight and better proteins, correspondingly by 3.81 g and 11.15 Haugh units than D459K. The amount of dry matter, crude protein and fat in egg mass was equivalent and met physiological norm indications. Reproductive tract organs in all groups but D459K were developed evenly. Liver mass in all groups showed no visible pathologies.

Keywords: *Laying hen, egg production, egg quality, reproductive tract, liver mass.*

APPLICATION OF THE INTERNET OF THINGS IN PRECISION BEEKEEPING IN LATVIA

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Abstract

Beekeeping is one of the traditional branches of agriculture and honeybees are very valuable economic insects, as they are the main pollinators in the world. Precision beekeeping is a sub-branch of the precision agriculture, which combines information and communication technologies with beekeeping and is aimed at managing an apiary more effectively to minimise the bee colony losses. Real-time, remote monitoring of the colonies applying information and communication technologies (ICT) can help the beekeepers to detect abnormalities and identify different states of the colony. One of the trending information technologies is the Internet of Things (IoT), which helps to link remotely located objects with the web services and data platforms. This research presents the IoT approach in precision beekeeping for the remote bee colony real-time monitoring system using the IoT SIM card for the data transfer. The approach is tested in a real apiary located in Platone, Latvia. Five systems were installed and used for bee colony temperature and weight monitoring. For the data management MQTT protocol and interactive visualization web application Grafana were used. As an IoT SIM card provider company 1NCE was selected, which provided SIM cards for the evaluation purposes. In addition, system power consumption and data volumes were evaluated within this research. It was evaluated that the system can operate up to 40 days before the need for the battery change or charge. IoT SIM cards worked properly. Using this approach beekeeper was able to remotely monitor the weight gain of the colonies and decide when to move the colonies to a new location.

Keywords: *Precision beekeeping, smart apiary, IoT, IoT sim card, HIVEOPOLIS.*

GRANULATED ANIMAL FEED ADDITIVES ON THE BASIS OF SEA BUCKTHORN BIOMASS

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Abstract

Our study aimed to evaluate sea buckthorn (SBT) 'Maria Bruvele' twigs and leaves biomass remaining as waste after berries harvesting, as a raw material for animal feed additives, with the investigation of their composition and nutritional potential. In this study, the initial chemical characterization of SBT waste biomass was carried out using the method of analytical pyrolysis. The results of analytical pyrolysis testified to the presence of condensed tannins (CTs) in the composition of the biomass, which are undesirable components for animal feed due to their possible negative effect on animals' weight gain and taste of the feed. Separation of CTs from biomass was carried out by extraction by a water-ethanol (1:1, v/v) solution. For the evaluation of SBT biomass residue after extraction as a raw material for the production of feed or feed additive, total protein, crude fat, ash, wood fibre, microelements (P, K, Ca, Na), and vitamins (A, C, E) content in the dry matter were determined. The amount of heavy metals (Hg, Pb, Cd) was determined as well, and by the Commission Regulation (EU) No 1275/2013, their amount in the analyzed biomass samples did not exceed the maximum permitted amount for animal feed. The SBT biomass granulation was carried out using the laboratory scale flat die pellet mill KAHL 14-175. The SBT-based feed pellets' properties, such as durability, moisture, bulk density, disintegration in water, and average pellets length were investigated. The investigation proved that SBT biomass is a unique underutilized source for animal feed additives.

Keywords: *Sea buckthorn twigs and leaves, biomass, granulation, animal feed additives, pellets.*

HORIZON 2020 RESEARCH PROJECT HIVEOPOLIS

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Abstract

Honeybees are important pollinators and support important ecosystems with their ecological services. There are several reasons for the decline in a beekeeping sector, like land-use intensification, pesticide poisoning, colony diseases, etc. These changes cause disruptive disturbances of their habitats which are endangering honeybee colonies around the world. The anthropogenic interferences are acting too fast to allow natural evolution of honeybees to cope with them, thus we aim to help the bees in coping with these adverse environmental factors by establishing technologies in and around a futuristic honeybee colony that allow the colony to perform well in very challenging environments. This project aims to make technologies available to honeybees that are naturally inaccessible for them (internet, databases, satellite data, and robots) and to feed information collected by bees through these channels back to us humans and also to other hives. This collection of hives, technologies and humans is called HIVEOPOLIS in our concept. HIVEOPOLIS technology will be integrated in a way that it provides a synergistic added value to the colony, to its owner and to society in general. Our society will benefit from the pollination services and other bee-derived services and products, in a more stable and controllable way, even in harsher ecological conditions. Ultimately, HIVEOPOLIS will bring honey bee societies into a new future and will integrate them into the hearts of our own future smart cities.

Keywords: *Precision Beekeeping, Precision Apiculture, Futuristic hives, HIVEOPOLIS.*

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INFLUENCE OF POLYMORPHISMS (2291A>C) AND (1548C>T) FOR GROWTH HORMONE (*GH*) GENE ON PRODUCTION TRAITS IN LITHUANIAN BEEF CATTLE

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Abstract

The aim of this study was to investigate the prevalence of *GH* gene polymorphisms (exon 5, 2291A>C; intron 3, 1548C>T) and to determine their influence on the productivity traits in beef cattle. In total, ninety five animals were genotyped, belonging to the breeds Angus, Limousin, Galloway and Simmental. Hair samples and the data on daily weight gain records were obtained from Šilutė control bulls feeding station. Polymorphisms of *GH* locus were identified using a *PCR-RFLP* method (*DdeI* and *MspI* restriction endonucleases). Evaluating the *GH* gene polymorphism 2291A> C it was found that the most common was allele A (frequency 0.947) and genotype AA (frequency 0.918) in the analyzed animals. Meanwhile, the homozygous CC genotype was found the rarest, with a frequency of 0.024. When calculating the influence of *GH* gene polymorphism (2291A> C) on cattle productivity traits, it was observed that this polymorphism had a statistically significant ($p < 0.05$) effect on cattle live weight, which was determined before cattle slaughter. Evaluation of genotype influence data showed that cattle of AC genotype weighed more than animals of AA or CC genotype. The examination of the *GH* gene polymorphism (1548C> T) revealed that the allele C (frequency 0.953) and genotype CC (frequency 0.906) were the most common. This polymorphism, influencing animal rate of weight gain, was statistically significant. Significant difference between the CC and CT genotypes was found for weight gain ($p < 0.05$). The CT heterozygotes gained more than CC homozygotes. In conclusion, the results showed that polymorphisms of the *GH* gene influenced some of the productivity traits of beef cattle.

Keywords: *cattle, GH gene, polymorphism, PCR-RFLP.*

ASSESSMENT OF HORSES HEALTH ACCORDING TO THE NUTRITION CHANGES

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Abstract

The study aimed to determine the horses' health characterization considering nutritional changes. The tasks were to evaluate the effect of a nutritional factor on horses, depending on their weight and physical activity and determine changes in horses' biochemical blood parameters depending on the diet. The study was performed in 2020-2021 at the horses' stables. During the study, 23 horses were kept in a horse stable A and 26 horses in a horse stable B. On the principle of analogues, 10 (n=10) horses were selected to evaluate their health, 5 (n=5) horses from each horses' stable. Feed samples were taken and analyzed in the evaluated horse stables: in stable A horses were fed with hay, and oats, and in stable B - with hay, oats, wheat bran, linseed meal, and corn. During the study year, data on the age, sex, activity, ration structure and feeding plan of each studied horse was collected and analyzed. It was found that the amount of metabolic energy and crude protein in both stables of horses was higher than the recommended nutrition level. Results show that the diet of horses affects biochemical changes in blood parameters and health. Studies of biochemical blood parameters in horse stable A were within the physiological norm, except for the mean alkaline phosphatase (ALP) which was higher than the physiological norm. The biochemical blood parameters of horses in stable B, such as alkaline phosphatase (ALP), iron and gamma glutamyl transferase (GGT) raise, were higher than the physiological norm.

Key words: *horses, feeding, health.*

RELATIONSHIP BETWEEN COW BREED, MILK YIELD, LACTATION AND SOMATIC CELL COUNT

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Abstract

Lithuanian Black and White (LBW), Lithuanian Red (LR) and Holstein (H) breeds are the main dairy cattle breeds raised in Lithuania. To investigate the relation between cow breed, lactation and milk somatic cell count (SCC), the study was carried out with 899 dairy cows. Data for analysis were taken from the „Alpro“ management system. The variation of SCC depending on the cow breed and lactation number was analyzed. Our results showed LBW produced the biggest amount of milk during 305 d. The highest milk yield produced by LBW breed 4th and over lactation cows was 10008.5 kg. LR and H breed cows in 1st lactation gave the lowest milk yield (7346.9 kg and 8016.8 kg), while the lowest milk yield of H breed in 1st lactation was 8089.4 kg. The highest number of somatic cells was found in the milk of 4th and over lactation cows, and the lowest in the milk of 1st lactation cows. The count of somatic cells in the 1st lactation cows' milk was about $609 \times 10^3/\text{ml}$ ($P < 0.05$), in the 2nd and 3rd lactation cows $516 \times 10^3/\text{ml}$ ($P < 0.05$) and $412 \times 10^3/\text{ml}$, respectively, it was lower compared with the 4th and over lactation cows' milk. The highest SCC in the milk was determined in the 4th and over lactation LR cows' milk ($1260.6 \times 10^3/\text{ml}$). The lowest count of SCC was determined in the milk of the 1st lactation LR and LBW cows. Holstein breed cows in the 2th lactation had the least SCC ($217.7 \times 10^3/\text{ml}$).

Keywords: *cattle, breed, lactation, SCC.*

INFLUENCE OF BIOR PREPARATION ON BOAR SPERMOGRAM

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Abstract

The aim of the research was to study the influence of biologically active preparations, extracted from *Spirulina platensis* (BioR) on the quantitative and qualitative indices of the usual spermogram in boars. The biological studied material was the Landrace boars and the semen material taken from them, raised at M. S. Moldsuinhibrid, Orhei, Republic of Moldova. The experiments were carried out between July and August, the months with hot temperatures. The boars were administered BioR preparation intramuscularly 0.3 ml / 100 kg live mass for 5 and 10 days, the preparation being produced at the Institute of Microbiology and Biotechnology of the Republic of Moldova. The sperm indices were studied before administration and 50 days after cessation of administration. The results showed that the mobility of sperm after 5 days of administration was 90%, after 10 days - 91%, compared to the control group where the mobility was 82% lower; the volume of ejaculate was 213 ml after 5 days and 229 ml after 10 days of administration of the preparation or by 25 ml and 41 ml, compared to the control group, and the fecundity increased by 3.29% and 4.57% compared to the control group where this index was only 75.83% (80.4% when the BioR preparation was administered for 10 days, and it was 79.12% after 5 days of administration).

Keywords: *Spirulina platensis* (BioR), boars, sperm indices.

SOLID-STATE FERMENTED WHEAT BRAN BASED DIET ON THE PERFORMANCE OF BROILER

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Abstract

This study evaluates the effects of solid-state fermented wheat bran (FWB) on the production performance, blood biochemistry, and histomorphological traits of broiler. One hundred fifty one-day-old broiler birds were assigned to five experimental groups (30 birds per group) with three replications (10 birds for each replicate). Experimental diets included: basal diet contains unfermented wheat bran (control group, FWB-0), and other groups unfermented wheat brans in the basal diet was replaced step-wise with FWB @ 25% (FWB-25), 50% (FWB-50), 75% (FWB-75), and 100% (FWB-100) respectively. Each group was fed these particular diets for 35 days. The inclusion of fermented WB in the broiler feed altered ($P < 0.01$) body weight gain, feed intake and feed conversion efficiency of broilers during the fattening (D8-35) phase. The highest ($P < 0.05$) feed intake and weight gain of broilers was recorded for FWB75 and FWB100 based diets during D8-35. Best FCR ($P < 0.05$) was reported for FWB75 and FWB100-based diet. Likewise, higher ($P < 0.05$) dressing percentage was found FWB100-based diet. Similarly, highest ($P < 0.05$) villus height was recorded for FWB100 group. Best antibody titer against ND was reported in the birds fed on FWB50, FWB75 and FWD100-based diets, respectively. In conclusion, the SSF-WB diet could be successfully applied to ameliorate the broiler growth performance, modulating intestinal morphology and a good economics index.

Keywords: *Fermented wheat bran, Performance, Biochemistry, Histomorphology*

STUDY ON AEROSOL EMISSIONS IN PIG FARMS

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Abstract

In pig farms, the level of emissions in the air is determined by several factors in the chain and their influence can be caused by: design and construction of buildings (halls), wastewater and manure collection system, ventilation system and discharged flows, temperature and heating system. The quantity and quality of pig manure that depends on: feeding strategy, feed recipe (protein level), water distribution and watering system, pig herds. The characteristic pollutants resulting from the pig breeding activity are: suspended particles, unpleasant odors, results in certain phases of the fermentation processes associated with the decomposition of zootechnical residues with gaseous emissions: ammonia, hydrogen sulfide, sulfur dioxide, methane, carbon dioxide, indole, box, volatile organic acids, aerosols, odors released during disinsection. Emission control in production halls is also an issue related to the living environment of animals. If a microclimate is not ensured in the halls according to the age and physiological condition of the animal, a high mortality rate or a low production may be reached, mainly due to respiratory diseases caused by inhalation of high concentrations of ammonia. Therefore, in farms where intensive pig farming is practiced, the production halls are equipped with ventilation systems that must ensure the parameters corresponding to the type of microclimate recommended.

Keywords: *pig farms, pollutants, air emissions, emission control*

RESEARCH ON LIVE FOOD PRODUCTION FOR FISH

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Abstract

In Romania, although the importance of live food in fish feeding is known, unfortunately, the results obtained so far have not materialized through their application in fish production units, the realization of such crops being a sporadic activity and concentrated almost exclusively at the level of fish research units. The main objective was to identify native species of protozoa, rotifers, copepods, cladoceres and aquatic philopods that are suitable for intensive cultivation, in order to achieve crops for biomass production and the development of cultivation technologies accessible to production units that have as specific production of juveniles from various species of fish. The research did not explicitly aim at inventing new techniques or cultivation facilities, the literature being very rich in this respect and most of them already having, internationally, an industrial character, but the use and adaptation of existing ones to native species and to the technological conditions in Romania. The advantages of creating zooplankton culture systems are numerous, of which the most important can be mentioned: independence from weather conditions, the possibility of scheduling biomass production, depending on technological needs, the possibility to correlate the size of the chicks with that of the live food provided. Internationally, intensive crops of organisms that serve as food for fish larvae and chicks are widely practiced, in recent years developing a branch of aquaculture that deals only with them.

Keywords: *live food, fish, feeding, Romania*

POTENTIAL ONCOGENIC EFFECT OF *DIROFILARIA REPENS* IN DOGS

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Abstract

The correlation between helminthes and tumors is open to question. We studied the morphology of neoplasms in 10 dogs, three of which were infected naturally with *Dirofilaria repens*, Railliet & Henry, 1911. Other 7 dogs were free from parasitical infection. Standard histological investigation with hematoxylin-eosin was performed. Histological analysis of both breast neoplasms from infected dogs revealed the presence of areas of breast tissue, multicellular, represented by papillary structures formed by small cells with large, hyperchromic nuclei. Among the cell complexes areas of fibrous tissue, zones of chondroid differentiation were found. Near the tumor tissue, cystic altered ducts are traced, lined with flattened epithelial cells without signs of atypia and proliferation. Thus, a histological diagnosis was obtained: papillary breast cancer and fibrocystic non-proliferative mastopathy. In the testis, the microscopic picture showed that the structure of the testes is typical. The stratification of the layers of the spermatogenic epithelium was relatively preserved. The stroma was dense, fibrous, with sclerosis. In the appendage, scleroplasic changes were also expressed with atrophic and cystic changes in the vas deferens. In 7 dogs without parasitic pathology, the following neoplasms were recorded: breast fibroadenoma; transmissible venereal sarcoma; diffuse lymphoblastic lymphoma in the oral mucosa; adenomyoepithelioma of the breast; lobular hyperplasia, ectasia of the ducts of the mammary gland; tubular-papillary adenoma of the nipple of the breast; chronic abscess of subcutaneous fat in the head area. In general, the relationship of infection with filariae and the oncological process in both animals and humans requires further study.

Keywords: *Dirofilaria repens* infection, dogs, inflammation, oncology.

**THE EFFECT OF AMBIENT TEMPERATURE ON EATING TIME AND
RUMINATION TIME AND MILK YIELD AND CHEMICAL COMPOSITION OF
MILK IN LACTATING COWS**

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Abstract

The paper presents the results of research on the influence of ambient temperature in different periods of the year on eating time, rumination time, and milk yield and chemical composition of milk in Simmental cows in the late lactation (over 150 days). Collars with sound-detecting sensors (GEA CowScout Neck) were used to monitor eating time and rumination time once per day. Ambient temperature was registered using data logger Testo 174T. The air temperature was measured every hour. It was noticed that different ambient temperatures affect the eating time ($p < 0.01$), rumination time ($p < 0.01$), milk yield ($p < 0.05$) as well as milk fat content ($p < 0.01$). The average ambient temperature of 11.88 °C had a positive effect on eating time (302.4 min/day), rumination time (379.8 min/day), milk yield (28.55 kg/day), and milk fat content (4.42%), compared to the average ambient temperature of 25.35 °C, where the observed eating time was 266.4 min/day, rumination time 345.6 min/day, milk yield 26.42 kg/day and milk fat content 4.12%. An increased chewing time was achieved at an adequate ambient temperature, as well as higher milk yield and improved milk composition.

Keywords: *dairy cattle, production performances, chewing activity, environment temperature*

INFLUENCE OF STIMULATIVE FEEDING MEASURES ON SPRING DEVELOPMENT OF BEE SOCIETIES IN DB AND LR HONEYCOMBS

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Abstract

In order for the bee colonies to make the most of the main pasture, and primarily black locust, it is very important that they are in good condition. It is necessary for the societies to reach their maximum strength at the beginning of the main pasture, and not for it to serve them for further development. The beekeeper himself plays a crucial role in the accelerated spring development of bee colonies. The aim of this study was to determine the effect of different ways of spring feeding on the strength of bee colonies and the food supply in them. The experiment was performed with companies that were in Db (Dadant-Blatt) and Lr (Langstroth-Ruth) hives. Four groups of companies were tested, and there were five companies in each group. The first group was supplemented with sugar syrup, enriched with vitamin-mineral complex - Foprsapine (10 drops per liter of syrup). The second group of societies was fed with honey dissolved in water (ratio of honey and water 1:1). The third group of the companies was fed with sugar dough (energy cake without additives). The fourth group of companies was supplemented with sugar syrup (the ratio of water and sugar was 1:1). At the beginning of the experiment, the societies in Lr hives had an average of 4.5 frames with bees, and 2.5 frames with a brood. In the Db hives, the societies occupied five frames with bees, and had 2.7 frames with a brood. At the end of the experiment Lr societies had 8.7 frames with bees, and 4.5 frames with brood, while Db societies had nine frames with bees, and 4.7 frames with brood. The experiment was performed at the apiary of the Institute for Forage Crops in Kruševac.

Key words: *honey bee, spring development, stimulating feeding, Db and Lr hive.*

ORGANIC WAY OF GOAT BREEDING AND GOAT PRODUCTION

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Abstract

Today, domestic goats are widespread throughout the world, with the exception of extremely cold areas. They are most represented in countries with extensive agricultural production, but in the last decade their population has also grown in richer countries, where there is a trend of increasing consumption of goat meat and milk. Goat meat is a food rich in proteins, vitamins and minerals, and contains very little fat, especially cholesterol. However, the biggest advantage, apart from the extremely high quality nutritional values, is that this type of meat does not have opposite religious and cultural aspects of consumption. Organic goat production is essentially reduced to returning to the original way of breeding through natural - grazing diet. Today's grazing is essentially different from the previous extensive grazing and is reflected in the fact that this diet is now approached from the modern aspect of sustainable agricultural production, which includes all elements of preservation and improvement of grazing areas, their cultivation, floristic composition and above all, avoiding chemical contaminants that would endanger the quality of the obtained green mass and thus the residual effect in the meat and milk of goats. Having in mind the pronounced trend of increasing the production and consumption of goat meat in the world and in Serbia, the aim of this paper is to show the impact of grazing as an organic way of obtaining the quality of goat meat.

Key words: *goats, meat, organic production, pastures*

QUALITY OF CHICKEN CARCASSES UNDER THE INFLUENCE OF PROBIOTICS AND PREBIOTICS

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Abstract

A significant place on the domestic and world market belongs to poultry production. In human nutrition, chicken meat as a high-quality product, high biological values and good digestibility has a significant function for the human body. The aim of this study was to consider the impact on the quality of chicken carcasses in fattening by including probiotics and prebiotics in meals, as alternatives to antibiotics. The probiotic *Bacillus licheniformis* and *Bacillus subtilis* and the prebiotic *Sacharomyces cerevisiae* were added at the 0.1% level. The experiment lasted 42 days, using two mixtures, initial up to 21 days and final from 21 to 42 days, and were the same for all groups in terms of energy and protein content, with the difference only in the added probiotic or prebiotic. The chickens were divided into three groups, where the first group was the control group of chickens. The second group was tested with the addition of probiotics 0.1%. The third group with the addition of prebiotics 0.1%. At the end of the experiment, after 12 hours of food deprivation, in order to eliminate the influence of external factors on weight relations, chickens were sacrificed (10 from each group). The assessment of the carcass quality was performed on the basis of the yield and the absolute and relative mass of individual parts of the carcass. The carcass control group yield of chickens had the lowest value, amounting to 73.04%. Rand yields of the experimental groups were slightly higher by 0.23% and 0.29% than the control group. No statistically significant differences were found. The experimental groups in the carcass of chickens had higher values of breast participation by 2.39% and back participation by 5.55% with probiotic supplement, as well as 0.71% for breast participation and 8.23 for back participation with prebiotic supplement, compared to 30.34%. for the participation of the breast and 13.16% for the participation of the back in the carcass of the chickens of the control group. The statistical significance of the differences was not determined. In the control group, the share of drumsticks and carcasses in the chicken carcass was 14.81% and 16.87%. In comparison with the control group in experimental groups in the carcass of chickens, lower values were found for 1.21% and 1.53% for the participation of drumsticks and carabaks with the addition of probiotics and 2.49% and 2.17% with the addition of prebiotics. The values of the participation of wings and cross in the carcass of chickens of the control group of chickens were 11.45% and 11.02%. Lower values were observed in the experimental groups by 4.96% and 1.71% with probiotic supplement, and 1.54% and 1.71% with prebiotic supplement, respectively. Probiotics and prebiotics in chicken feed rations had a positive effect on carcass quality, by increasing the yield as well as certain basic parts of the carcass, the values of the differences were not statistically significant.

Keywords: *broilers, probiotic, prebiotic, carcass quality*

ALTERNATIVE METHODS OF PLANT PROTECTION IN ORGANIC PRODUCTION

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Abstract

In conventional plant production, cultivation of monocultures, deep cultivation, a large number of passes of heavy mechanization, application of chemical fertilizers impairs the structure and quality of the soil. In order to protect against weeds, pests and diseases, the excessive use of pesticides results in greater environmental pollution, poorer quality of both plant and animal products, significantly reduced food safety and a negative effect on human and animal health. In order to mitigate the negative impact on the environment, improve the quality and fertility of the soil, preserve health products safe in terms of quality and safety of plant products and products of animal origin, a new approach and biological plant protection are of great importance. The aim of this paper is to present the application of control methods as an alternative to plant protection from weeds, diseases and pests, preparation and application of biological products in crop, vegetable and fruit production

Keywords: *organic production, control, methods, biopreparations*

EFFECT OF PROBIOTICS ON THE CHEMICAL COMPOSITION OF MEAT

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Abstract

The application of probiotics of *Bacillus licheniformis* and *Bacillus subtilis* cultures in chicken feed used as an alternative to antibiotics, determination and consideration of the influence on the chemical composition of chicken meat, was the goal of this research. The 42-day experiment included 104 one-day-old chickens of the fast-growing Coob 500 hybrid, divided into two groups. The first group was controlled with standard meals, the second group was tested with a probiotic supplement of 0.1%. Two mixtures were used, starting up to 21 days and ending from 21 to 42 days, and were the same for both groups in terms of energy and protein content, with the only difference being the added probiotic. At the end of the experiment, 20 chickens were sacrificed (from each group of 10) and the chemical composition of white meat - breast and red meat - drumsticks and drumsticks was determined. Probiotics did not have a significant effect on the examined parameters of the chemical composition of chicken, thigh and carabiner meat, and it had a positive effect on increasing the protein content and reducing the fat content.

Keywords: *broilers, probiotic, chemical composition*

SUPPLEMENTS IN THE NUTRITION OF DOMESTIC ANIMALS

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Abstract

The paper gives an overview of categories and basic characteristics of permitted additives in the diet of domestic animals, which are based on functional properties grouped into nutritional, technological, sensory, zootechnical, enzymes and microorganisms, important for meeting nutrient needs, improving production results, maintaining health and obtaining quality products for human consumption. Vitamins, provitamins and chemical substances with similar action, mineral mixture, amino acids, their salts and analogous substances, urea and its derivatives are nutritional supplements. Colors (carotenoids and xanthophylls), substances that increase or renew the color in animal feed and enhance the color of food of animal origin, aromatic natural or corresponding synthetic chemically defined aromas form a category of sensory additives. The category of permitted technological additives includes preservatives, antioxidants, emulsifiers, stabilizers, thickeners and gelling agents, binders, radionuclide contamination control substances, anticoagulants, acidity regulators, ensiling additives - enzymes and microorganisms, reducing substances for food animals with mycotoxins (trichothecenes, fumonisins, aflatoxin B1), substances to improve the hygienic condition of the substance. Zootechnical additives are substances for improving the digestibility of nutrients, stabilizers of the good intestinal flora - enzymes and microorganisms, substances that have a beneficial effect on the environment and other zootechnical additives.

Keywords: *nutrition, nutrients, technological, sensory, zootechnical additives*

HUMAN-ANIMAL RELATIONSHIP AS A FACTOR OF CALF WELFARE IN THE FIRST MONTH OF LIFE

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Abstract

Contact with a breeder is extremely important for the welfare of calves in the first month of life. In the intensive way of raising cattle, it is increasingly difficult to establish a good relationship between breeders and animals. The authors defined 12 criteria for assessing animal welfare, which they classify into four groups, one of which is good behaviour in terms of social and other forms of behaviour and a good human-animal relationship. This implies the absence of fear because fear is an important animal welfare problem. The attitude of farmers towards calves in the first month of life was examined on two farms with an intensive production system. The relationship of humanstocalves was assessed using the test of approach and touch. Farmers competence assessments on the surveyed farms were satisfactory. It is characteristic of both farms that breeders who handle calves do not have a formal education in the field in which they work. Accordingly, their knowledge and skills are based on many years of work experience. The approach and touch test indicated a positive relationship between breeders and calves. The largest number of calves allowed approaching 1 or 2 steps, and a significant number also allowed touch, while a negligible number of calves avoided eye contact, as the most unfavourable type of contact.

Keywords: *human-animal relationship, calf welfare, approach and touch test.*

NUTRITIVE VALUE AND THE POSSIBILITY OF USING APPLE POMACE IN THE NUTRITION OF DAIRY COWS

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Abstract

The aim of this study is to analyze the nutritional value of apple pomace and to review the possibility of its use as a feed in the diet of dairy cows. Apple pomace is a by-product of apple juice production, making up approximately 20-30% of processed apples. Several million tonnes of this by-product are generated annually in the world. Despite increasingly strict legal regulations in biodegradable waste management, large amounts of apple pomace are still disposed of in landfills, posing a serious environmental issue and requiring new ways of its treatment or further use. Apple pomace is a rich source of carbohydrates - dietary fiber and sugars, also containing lower amounts of proteins and fat, minerals and vitamins, which makes it a potential feedstuff in the diet of farm animals. It is considered to be a valuable energy feed for ruminants and can replace conventional feedstuffs such as maize and other cereals. Due to its high moisture content, fresh apple pomace is susceptible to spoilage, thus, it has been mostly used in dry or ensiled form when it comes to the nutrition of dairy cows. In the conditions of unstable supply and prices of conventional feedstuffs, introduction of alternative feedstuffs is gaining importance. Therefore, further study of apple pomace, with a focus on its content and form (fresh, dry or ensiled) is needed, in order to examine the impact on production performance, product quality and the health of dairy cows and other species and categories of farm animals.

Keywords: *Apple pomace, Nutritive value, Animal feeding, Dairy cattle*

EFFICIENCY OF APPLYING DIFFERENT CONCENTRATIONS OF OXALIC ACID IN BEE COLONIES AGAINST *VARROA DESTRUCTOR* IN WINTER PERIOD

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Abstract

Since in winter period there is no bee brood in a bee hive there is no development of varroa inside the hive as well so the individual varroa are compelled to live on adult bees. In order to suppress them an oxalic acid solution is most commonly used. The objective of a present research was to study the efficiency of different concentrations of oxalic acid (OA) applied against varroa mite. The treatment was carried out on a one-time basis in December 2021. Two groups of bees were formed with nine bee colonies in each one equalized in strength. The first group (I) was treated by a solution containing 42 g OA diluted in 1 litre 1:1 sugar:water (weight:volume), and concentration of OA was 0.333 mol/l. The second group (II) was treated by the solution containing 100 g OA diluted in 1:1.5 sugar:water (weight:volume), and concentration of OA was 0.707 mol/l. Using a syringe 5 ml of solution was dripped on bees between the frames of bees. The efficacy of treatment was determined by counting the varroa dropped on bottom board within the period of 28 days. In the first spring examination a quantity of bees was determined. An average number of daily dropped varroa as of 1.94 in I group did not significantly differ ($P>0.05$) in relation to 1.47 dead varroa in the second group. A quantity of bees in spring examination was by 12% higher in I group ($P>0.05$). After wintering the loss of two bee colonies in II group was determined. On the basis of the research results it has been determined that an increased concentration of oxalic acid in solution applied against varroa in winter treatment was less efficient compared to normally applied concentration and showed inferior results regarding winter surviving of bees.

Keywords: *Honeybee, Oxalic acid, Different concentrations, Varroa destructor.*

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INFLUENCE OF PROTEOLYSIS AND LIPOLYSIS IN SILAGE ON MILK PRODUCTION AND MILK FAT COMPOSITION IN RUMINANTS

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Abstract

The overview of domestic and foreign research was given in the paper about the influence of proteolytic and lipolytic changes in silage on milk production and milk fat composition. During the preparation (wilting) of plant material for ensiling, lipolysis and oxidation of fatty acids occur, which hurts the content of polyunsaturated fatty acids (PUFA) in silage and milk fat. The exception is corn silage, which is prepared without wilting. However, its use leads to the biohydrogenation of linoleic acid to *trans*-10, *cis*-12 CLA, which is a very potent inhibitor of milk fat synthesis. Lactic acid bacteria decompose carbohydrates during fermentation in ensiled material, resulting in lactic, acetic, and butyric acids. These acids are used for energy production in ruminants, but due to their volatility, they affect the relative changes in the chemical composition of silage. By the influence of enzymes from plant cells of ensiled material or butyric acid bacteria, intensive proteolysis occurs, whose end products are peptides, free amino acids, and ammonia. These products lead to a significant increase in the fraction of degradable proteins in some silages (alfalfa), which hurts the utilization of total meal protein and production. Conversely, red clover is a more suitable material for ensiling due to the partial reduction of lipolysis and proteolysis by polyphenol oxidase. Using modern inoculants, fermentation is intensified, fermentable carbohydrates are used to the maximum, and the aerobic stability of silage is increased. During the fermentation of the ensiled mass and when using some strains of lactic acid bacteria as inoculants (*Lactobacillus Plantarum* AKU 1009a), there is a biohydrogenation of some PUFAs and an increase in the content of conjugated fatty acids in the silage itself.

Keywords: *silage, lipolysis, proteolysis, milk, fatty acids.*

CHARACTERISTICS OF EMBRYONIC DEVELOPMENT OF MUSCLE CELLS OF BROILER AND LAYER CHICKENS

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Abstract

Observations of broilers and layers in the postnatal period of development show differences in their weight, feed intake, growth rate, etc., which is related to different purposes of these hybrids in poultry farming. The aim of this paper was to examine characteristics of embryonic development of skeletal muscle cells of broiler and layer chickens. In this study, 800 eggs of two types of chicken hybrids – broiler (*Ross 308*) and layer (*Hy-Line Brown*) were incubated, 400 eggs of each hybrid. Tissue samples of leg and breast muscles were taken on embryonic days 9, 12, 15, 18 and 20, as well as on day 1 post hatching. From tissue samples histological preparations were made and the diameter of muscle cells as well as the volume density of connective tissue of muscles were observed. Comparing the diameter of muscle cells of leg and breast muscles between broiler and layer chickens, it was established that layer chicken had higher diameter of examined muscle cells on embryonic days 18 and 20, as well as on day 1 post hatching. There were no differences in volume density of connective tissue of muscles between broiler and layer chickens during all days when tissue samples were taken. These results can be explained by increased proliferation of myoblasts and delayed differentiation of muscle cells in the embryos of broiler chickens, which leads to higher postnatal development of skeletal musculature of broilers, but smaller muscle cells diameter during embryonic period of development. The results of this experiment present a contribution for further researches related to development of skeletal musculature of broiler and layer chickens.

Keywords: *Broiler chickens, Layer chickens, Skeletal musculature, Embryonic developmet.*

INFLUENCE OF INCREASED INCUBATION TEMPERATURE ON POSTNATAL DEVELOPMENT OF SKELETAL MUSCULATURE IN BROILERS

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Abstract

Changes of incubation factors could affect the characteristics of embryonic and postnatal development of chickens. The aim of this paper was to examine the influence of increased incubation temperature on postnatal development of skeletal musculature in broilers. Broiler eggs were set in four incubators (200 eggs in each incubator) depending on the temperature during the incubation: control group A (incubated at 37.8°C) and groups with increased incubation temperature to 38.5°C (group B), 39.5°C (group C) and 41.0°C (group D). After hatching, chicks were grown up to the age of 42 days, when for the purpose of the histological examination, samples of breast muscles of 20 chickens from each group were taken and the muscle cells diameter, as well as the volume density of connective tissue in muscle were observed. Analysis showed that muscle cell diameter of chickens which incubation temperature was increased to 38.5°C and 39.5°C was higher compared to control group. Between group which incubation temperature was increased to 41.0°C and control group, there were no differences in diameter of muscle cells. Between all groups, there were no differences in volume density of connective tissue in muscles. It can be concluded that increased incubation temperature to 38.5°C and 39.5°C has a positive influence on the growth of skeletal muscle cells of chickens, while increased incubation temperature to 41.0°C has no effect on skeletal muscle cells growth. Those changes can be explained by the influence of increased temperature (up to 39.5°C) on the enhanced myoblast proliferation, prolonged skeletal muscle cells differentiation, as well as the increased postnatal muscle cells growth. These results may be useful in further studies related to influence of incubation temperature on postnatal development of skeletal muscles.

Keywords: *Broiler chickens, Skeletal musculature, Incubation temperature.*

ASSESSMENT OF ANTIMICROBIAL RESISTANCE IN LACTOBACILLI ISOLATED FROM TRADITIONAL SERBIAN CHEESES

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Abstract

Food chain is recognized as a possible route for the transmission of antibiotic-resistant bacteria between animal and human populations. Since lactic acid bacteria can serve as a reservoir for antibiotic resistance determinants, antimicrobial resistance should be assessed as a safety criterion. The aim of this study was to investigate phenotypic resistance in 92 isolates of lactobacilli (*Lb. plantarum*, *Lb. paracasei*, *Lb. brevis*, *Lb. kefir*, *Lb. curvatus*, *Lb. parakefir*, *Lb. paraplantarum*, *Lb. coryniformis*, and *Lb. diolivorans*) originating from traditional Serbian raw milk cheeses. Minimal inhibitory concentrations were determined by broth microdilution method for the following antibiotics: gentamycin, kanamycin, streptomycin, tetracycline, erythromycin, clindamycin, chloramphenicol, and ampicillin. The isolates were classified as susceptible or resistant to antibiotics, based on the cut-off values proposed by EFSA. Forty-one isolates (44.57%) were susceptible to all analyzed antibiotics. Among antibiotic-resistant isolates, thirty-seven (40.22%) were resistant to one antibiotic. Resistance to kanamycin, as the most prevalent, was determined in 32 (34.78%) isolates, while resistance to ampicillin, as the least prevalent phenotypic resistance, was found in a single *Lb. plantarum* isolate. One isolate belonging to *Lb. brevis* showed multiresistance (resistance to three or more antibiotics, belonging to different classes) against kanamycin, clindamycin and chloramphenicol. Results of this study indicate that lactobacilli from traditional Serbian cheeses do not serve as a potential reservoir for antibiotic resistance. However, in order to ensure food safety, it is necessary to further characterize resistance to antimicrobials in lactic acid bacteria populations originating from traditional Serbian cheeses.

Key words: *Lactobacilli*, *Antimicrobial resistance*, *Traditional cheese*.

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EFFECTS OF PROTEASE, DURATION OF FATTENING PERIOD AND SEX OF BROILERS ON CARCASS CONFORMATION MEASURES

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Abstract

This study analyses the effect of different protein levels in broiler feeds (supplemented with protease), different lengths of fattening period and sex on body conformation in fast-growing Cobb 500 broilers. Complete feeds for broilers in experimental groups E-I and E-II contained 4 and 6% less crude protein than the control (C) and were supplemented with protease (Ronozyme Pro Act) at a concentration of 200mg/kg feed and 300mg/kg feed respectively. At 49 and 63 days of age, 10 male and 10 female broilers were randomly selected from each experimental group and slaughtered. Body conformation measurement included absolute carcass conformation measures (metatarsus length, keel length, breast depth, breast angle, thigh girth) and relative body conformation measures - conformation indices (body weight/metatarsus length, body weight/keel length, body weight/breast depth, body weight/thigh girth). The results showed that dietary treatment did not affect conformation measures, as well as that the time of slaughter and sex of chickens had a significant effect on the examined carcass quality parameters. Namely, the length of the fattening period affected all conformation indices, as well as some absolute measures of carcass conformation - metatarsus length, keel length and thigh girth, while sex had a significant effect on the values of the all absolute values of carcass conformation (except for breast angle) and indices body weight/keel length and body weight/breast depth.

Keywords: *broilers, body conformation, feeds, lengths of fattening period, sex.*

LEVEL OF RADIOACTIVITY OF NATURAL AND PRODUCED RADIONUCLIDES IN ANIMAL FEED

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Abstract

Radioactive elements along with their decay products are present in most environmental matrices and can be transferred to living bodies by different pathways which can lead to the sources of exposure to man. For these reasons, it has been necessary to monitor those natural radionuclides in feed samples to assess the possible hazards. The study included a total of 19 samples (feedstuffs, mineral and vitamin premixes, complete mixtures). Activity concentrations of radionuclides gamma emitters were determined by the method of low-level gamma spectrometry on high resolution HPGe detector system produced by ORTEC. The amount of homogenized sample was weighed and decomposed using the wet digestion method at the system Ethos, Microwave Labstation, Milestone. Thorium and Uranium content was determined using Agilent 7700x Series ICP-MS (inductively coupled plasma mass spectrometry) and data analysis was performed by MassHunter Workstation software. The results revealed the presence of the following natural radionuclides: ^{40}K , ^{226}Ra , ^{232}Th , ^{235}U and ^{238}U . Besides, the presence of Cs-137, that is, an anthropogenic (artificially produced) radionuclide has been confirmed (Fish meal). It can be concluded that in most of the tested samples, potassium-40 was the predominant natural radionuclides as compared to other radionuclides. The highest Th-232 activity was measured in the mono-ammonium phosphate sample (1017 Bq / kg) and the highest U-238 activity was measured in the mono-calcium phosphate sample (5304 Bq / kg).

Keywords: *Natural radionuclides, Artificial radionuclides, Animal feed*

OCCURRENCE OF CHEMICAL ELEMENTS IN EWE TISSUES FROM UNDISTURBED AND SLIGHTLY DISTURBED AREAS IN SLOVAKIA

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Abstract

This study aimed to measure concentrations of selected essential and toxic elements (Ag, Al, As, Ba, Ca, Cd, Co, Cr, Cu, Fe, K, Li, Mg, Mn, Mo, Na, Ni, Pb, Sb, Se, Sr, Zn) in animal tissues of sheep originating from the area with a slightly environmental burden (Horehronie region) and undisturbed area (Orava region) in Slovakia. Liver, kidney, mammary gland, and muscle from 22 ewes for two consecutive years (2020 and 2021) were analysed by an inductively-coupled plasma optical emission spectrometry. Various concentrations of monitored elements were obtained after subjecting the results to statistical analysis. Contents of five toxic elements (arsenic, cobalt, nickel, lead, antimony), and chrome and selenium, were below the detection limits. Content of cadmium exceeded the maximum permissible level in kidneys from the slightly disturbed area. Although the content of copper did not exceed the permissible limit, the concentration of Cu was higher in the liver in both areas in 2021 compared to the results from other studies. The concentration of lithium in the kidney, liver, and muscle from the Orava region was significantly ($P < 0.05$) higher than that of the Horehronie region. Concentrations of Mg, Ag, Cd, Mo, and Zn were significantly ($P < 0.05$) higher in samples from region Horehronie than that in the Orava region. Statistically significant differences ($P < 0.05$) were noted between concentrations of K, Li, and Mo in kidneys; Fe, K, and Li in the mammary gland; Cu, Zn in the liver and Mn in muscles of sheep across the reference years. In summary, monitoring the occurrence of elements found in commonly consumed dietary raw materials contributes to ensuring the quality and safety of food. Most of the tissue samples analysed are relatively safe for regular human consumption. However, the concentrations of Cd in the kidneys from the slightly disturbed area and potentially Cu in the liver from both areas pose a health risk for the consumers.

Keywords: *toxic elements, essential elements, animal tissues, sheep, Slovakia*

APPLICATION OF CONTROL MEASURES IN A FREE-RANGED PIG FARM WITH A BACKGROUND OF PORCINE LYMPHADENITIS

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Abstract

Porcine lymphadenitis is a chronic disease affecting to free-ranged pigs. *Mycobacterium Tuberculosis* complex (MTC), *Trueperella pyogenes* and several *Streptococcus* species are the main pathogens related to the finding of tuberculosis-like lesions (TBL), one of the main cause of carcasses condemnation at the slaughterhouse with a relevant economic impact for producers. Vaccination and biosecurity strategies are considered the most appropriate control measures against this pathology. This study was performed in a free-ranged farm of Iberian pigs located in the South of Spain with a high density of wild animals and a background of condemnation rates ranging from 20 to 50% due to TBL. In total, 500 pigs got vaccinated using an autovaccine that was made with a combination of isolates of gen. *Streptococcus* and *Trueperella*, and involved three doses. Also, some biosecurity measures were performed, such as the installation of a hunting mesh. After slaughtering pigs at the abattoir, 18 pigs (3.6%) were totally condemned and 3 (0.6%) were partially condemned. Submandibular lymph nodes, lungs, liver and spleen were sampling to perform a real time PCR targeting IS6110 and confirm the presence of MTC. All the analysed pigs (100%) were positive to MTC. These results suggest a moderate efficacy of the vaccination, but also the need to conduct biosecurity measures for controlling MTC. Moreover, in the case of free-living farms, more severe and reliable biosecurity protocols should be managed including specific cleaning, disinfection protocols, control and monitoring of wildlife population avoiding possible interactions between pigs and these reservoirs.

Keywords: porcine lymphadenitis, *Mycobacterium tuberculosis complex*, tuberculosis, PCR, free-ranged pigs.

PRESENCE OF SEXUAL DIMORPHISM BUT NO ECOTYPES AMONG FREE-RANGING MUSCOVY DUCKS IN GUATEMALA

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Abstract

In this study, we investigated the sexual dimorphism between males and females of Muscovy ducks raised freely in three different local communities in Guatemala. The analysis was based on 14 important morphological traits -arm length, shank length, total height, head length and head width, body length and width, dorsoesternal length, croup height, body, breast and abdominal perimeters, metatarsus perimeter and body weight- in a sample constituted by 137 males and 225 females. Males presented higher massiveness than females, but being less stocky and legged. The discriminant analysis revealed that males could not be grouped into groups, but females from Camotán appeared separated from the rest. Detailed analysis demonstrated that most differential variables (abdominal and chest perimeters) were not related to ethnological traits, so Camotán group can be considered as a mere topotype (associated with artificial selection and breeding) rather than an ecotype (associated to local ecological conditions). Sexual dimorphism is well manifested. The smaller body exhibited by the females as compared to the males can be a reflection of their adaptive strategy to the stressful environmental and nutritional conditions, as smaller size would reduce the maintenance feed requirements and increase feed efficiency in this free range system where feed resources are limited in terms of quantity and quality. The results of this study might be effective in characterization and conservation of the Muscovy duck in Guatemala and to register this breed internationally. But there is a need to study carcass and egg quality as well as variability at molecular levels to clarify the similarity with ducks from other Iberoamerican countries.

Keywords: *biodiversity; criollo; drake; indigenous; morphological variation*

LOW FAT LEVELS IN THE MILK IN THE BARROSA-SALMECO CREOLE BREED COW

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Abstract

It is well known that milk composition is affected by the breed and genotype of a cow. The Barroso-Salmeco cow, typical of the Department of Santa Rosa, Guatemala, constitutes a population of brevilineous cattle, with a long and narrow head, robust body, long and narrow pelvis; present sexual dimorphism, high reproductive capacity, and double meat-milk aptitude. The objective of this study was to establish some parameters of the composition of milk in this cow. To do this, milk samples were collected from 27 Barroso-Salmeco females in different lactation periods, with a total of 133 analyzed samples. The variables studied: fat, total protein, lactose, non-fatty solids. The average fat was 1.80 g/L, non-fatty solids 8.76 g/L, protein 3.39 g/L and lactose 4.73 g/L. Fat values are outside the normal values expected for a dairy breed. The trends for fat percentage observed here are quite contrary to expectations, since indigenous animals tend to have milk with higher fat percentage. The number of births and milk components appeared negatively correlated. Our results contribute to the knowledge of dairy components in local breeds maintained in the tropics.

Keywords: *Creole cattle, Dairy cattle, Milk composition*

COMPARING THE EGG QUALITY TRAITS OF DIFFERENT LAYER GENOTYPES RAISED IN A FREE-RANGE SYSTEM

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Abstract

The aim of this study is to compare different layer hybrids in free-range system in terms of some egg quality characteristics. Lohmann Brown (LB) at 32 weeks of age as commercial layer hybrid and ATA-S (AT) genotype, which is domestic layer hybrid material, were used. Egg weight, shell color, eggshell strength and Haugh unit were investigated as egg quality characteristics. Quality analyses were carried out on 20 randomly taken eggs from eggs produced for two consecutive days of each genotype. It was determined that the eggshell color L value of the LB genotype (59.26) was lower than the eggshell L value of the AT genotype (66.69) ($P<0.05$). Eggs obtained from LB genotype were found to be heavier in terms of egg weight ($P<0.05$). Egg shell strength was found to be higher in eggs obtained from LB genotype (4.68 kg) than eggs obtained from AT genotype (3.79 kg) ($P<0.05$). It was determined that the Haugh unit (93.78) of the eggs obtained from the LB genotype was higher than the Haugh unit (84.44) of the eggs obtained from the AT genotype ($P<0.05$). As a result, it was observed that the quality characteristics of eggs obtained from LB genotype in the free-range system were better than the quality characteristics of eggs obtained from AT genotype.

Keywords: *Genotype, egg quality, free-range system.*

INVESTIGATING THE EFFECTS OF CERIUM NITRATE (CN) AND PLATELET-RICH PLASMA (PRP) TREATMENTS ON THE RAT TESTICULAR TISSUE IN RECOVERING STASIS ZONE AFTER BURNS

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Abstract

Post-burn trauma is common in daily life. Although a burn injury causes traumatic damage on the skin, it can also cause damage on many tissues and organs, including testicular tissue, as a result of systemic inflammatory reactions in the body. Cerium nitrate (CN) and Platelet-Rich Plasma (PRP) are natural compounds having anti-inflammatory, antioxidant and anti-apoptotic properties. For this reason, in this study, the protective effects of CN and PRP as well as their efficacy were investigated in testicular tissue damage following skin burn. Thermal damage was induced in the skin tissues of the rats on the first day of the study. Then, the rats in the CN group were kept in a 30-min bath of 0.04 M (molar) Cerium Nitrate. The rats in the PRP group received 0.1 ml of PRP intradermal injections in the wound area. Spermatological examinations performed after burn revealed that abnormally shaped sperm counts increased and the integrity of the sperm membrane was impaired. In histopathological examinations, thinning of the tubular walls in testicular tissues were observed, as well as decrease in spermatocyte numbers and severe degeneration and necrosis in the spermatocytes. It was also observed that the burn triggered inflammation in testicular tissues by increasing IL-1 β , TNF- α and NOS levels, caused DNA damage by increasing 8-OHdG levels, and furthermore caused apoptosis due to increased Caspase 3 expression in the testicular cells. It was determined that CN and PRP treatments reduced the number of abnormally shaped sperms after burn, maintained membrane integrity of sperms, and suppressed inflammation, oxidative stress and apoptosis in testicular tissues. Based on these findings, it was demonstrated that both CN and PRP have protective effects in testicular tissues by suppressing the systemic inflammatory reactions and oxidative stress developing in the body after burns.

Keywords: *Apoptosis, Inflammation, Platelet-Rich Plasma, Cerium nitrate, Burn*

COMPARISON OF FEAR RESPONSES AND GROWTH CHARACTERISTICS OF QUAILS REARED IN DIFFERENT CAGES AND STOCKING DENSITIES

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Abstract

The aim of this study was to compare tonic immobility durations and growth characteristics of Japanese quails reared in individual and battery type cages at seven different stocking densities. A total of 436 quails were used in the study. Stocking densities per quail in battery type cages were set as 160 cm², 180 cm², 200 cm², 220 cm² and 240 cm². In individual cages, stocking densities were 280 cm²/quail and 360 cm²/quail. In the study, there was no statistical difference between the experimental groups in terms of the six-week live weight averages of the birds. Similarly, there were no statistical differences in the parameters of the Gompertz growth curve between the groups. However, a statistical difference was determined in terms of tonic immobility averages of quails in the experimental groups. While the lowest tonic immobility average (56.49 sec) in battery type cages was measured in quails housed in the 240 cm²/quail stocking density group, the averages of those in the other groups were found to be higher (P<0.05). Similarly, quails reared in larger individual cages had lower tonic immobility average (83.55 sec.) than the other group. As a result, it is possible to say that stocking density and cage type affect the fear responses of Japanese quails.

Keywords: *Japanese quail, Tonic immobility, Stocking density, Battery cage, Individual cage*

IS THE JAPANESE QUAIL A PRODUCTION MATERIAL OR A MODEL ANIMAL?

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Abstract

Japanese quail has been used for many years both for commercial production and scientific studies. In the past, the commercial production volume was quite low due to its low yield characteristics. However, with the widespread use of lines developed for meat and egg production in recent years, the production volume has also increased. Especially in developing countries, quail consumption is expected to increase much more. The Japanese quail, whose commercial importance is increasing, is also increasing in the rate of taking part in scientific studies. In particular, obtaining information that can be transferred to other poultry species more easily increases the scientific value of Japanese quails. As a result, Japanese quail, which was defined as a "model animal" in the past, is now turning into a "production animal". However, this does not mean that this transformation will negatively affect its importance in scientific studies. On the contrary, the Japanese quail is both a breeding material and a model animal.

Keywords: *Japanese quail, Genetic improvement, Commercial production, Meat, Egg yield*

EFFECTS OF PLUMAGE COLOR MUTATIONS ON GROWTH, FEED EFFICIENCY, AND CARCASS CHARACTERISTICS IN JAPANESE QUAIL

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Abstract

The aim of this study is to determine the performance traits of the quail plumage color mutants (Golden, Italian, Black, White, and Wild) with the Gompertz growth function. A total of 100 birds from plumage color mutants (Golden, Italian, Wild, White, Black) with mixed sexes were used in the study. All quails were wing banded and then weighted weekly hatching to six weeks of age. The feed consumption of quails was determined on a weekly basis, and they were slaughtered at six weeks of age. It was determined that the difference in body weight between plumage color mutation groups first appeared between the 14-21st days and continued to exist until the end of the trial. The higher live weight (197.64 g) on day 42 is in quail with the golden color mutation than mean values (163.33-177.31 g) of other genotypes ($P<0.05$). Although similar results were observed in terms of carcass weight and abdominal fat weight ($P<0.05$), there was no difference between genotypes in terms of feed efficiency ($P>0.05$). As a result, it was determined that Japanese quails with different feather colors differed in terms of their performance characteristics.

Keywords: *Japanese quail, Plumage color, Body weight, Feed efficiency, Carcass*

INVESTIGATION OF THE EFFECT OF INTRANASAL LTA AND LPS IMPLEMENTATION ON GENE EXPRESSION IN THE IMMUNE SYSTEM PATHWAY WITH CORRELATION ANALYSIS IN SHEEP

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Abstract

In this study, Lipoteichoic acid (LTA, n=7, 50 µg/kg), Lipopolysaccharide (LPS, n=7, 20 µg/kg) and LTA-LPS mixture (n=7, 50 µg/kg + 20 µg/kg) and PBS (control, n=7, 250 µl) were administered via intranasal route to Akkaraman lambs. The differences in the expression of TLR2, TLR4, MyD88, TRAF6, TNF- α , IL-1 β , IL-6, IL-10, NF- κ B and IFN γ genes using GAPDH and β -actin as reference genes, and the relationship of genes with each other's both in different and in the same time periods were determined with qRT-PCR in PBMCs isolated at the 24th hour and on the 7th day after administration. The correlation coefficient and statistical significance between the normalized expression data of genes were examined by Spearman rho correlation analysis. Considering the obtained results at the 24th hour; high and statistically significant (p<0.05) positive correlations were determined between *TLR2-IL10*, *NF- κ B*, *NF- κ B-IL-10* genes in the control group; between *TLR2-TNF- α* , *IL-10*, *TLR4-MyD88*, *IL-1 β* , *MyD88-IL-1 β* , *IFN γ -TRAF*, *NF- κ B*, *TNF- α -IL-10* genes in the LTA group; between *TLR2-TRAF6*, *TNF- α* , *IL-10*, *IL-10-TLR4*, *TRAF6*, *IL-1 β* genes in the LPS group and between *TLR2-IL-10*, *TLR4-TRAF6* genes in the mixture group. On the 7th day, high level of (p<0.05) positive correlations were determined between *TLR2-TLR4*, *IL-1 β* , *IL-10*, *IFN γ* , *TLR4-IL10*, *TRAF6-NF- κ B*, *TNF- α* , *IL1- β -IL-10* genes in control group, between *TLR2-TLR4*, *TNFA*, *IL-10*, *TLR4-MyD88*, *NF- κ B*, *TNF- α* , *NF- κ B*, *MyD88*, *TNF- α* genes in the LTA group and between *IL-10-IFN γ* genes in the LPS group whereas a statistically significant high level of negative correlation (p<0.05) was determined between NF- κ B-IL-1 β genes in the mixture group. Considering the correlation between time periods, moderate and high level of negative correlations (p<0.05) were observed between genes in all groups except the control group. According to the obtained results, the applied molecules activated different genes in different groups at the 24th hour and the activity decreased on the 7th day.

Keywords: LTA, LPS, sheep, PBMCs, immunity.

POULTRY BEHAVIOUR AND WELFARE

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Abstract

The concept of welfare in poultry has gained importance in recent years and has been shaped by some demands of societies. Behavior is the first indicator for understanding welfare status of birds. If chickens can display their natural behavior within their rearing system, it is widely an accepted approach to say that their welfare status is good. However, as a result of the high stocking density of broilers in the confined systems and laying hens in conventional battery cages, many people are concerned about the welfare of birds. In these intensive and compelling production models, birds cannot exhibit their natural behaviors, their fear levels increase, they are exposed to stress, and naturally their well-being is adversely affected. In order to solve this problem, welfare-friendly alternative rearing systems have been developed for broilers and enriched cages have been used for layers. All these alternative production systems and enriched cages have been designed so that birds can exhibit their natural behaviors and therefore increase their welfare level. Studies on bird behavior have also increased in parallel with these developments. The aim of this study is to introduce what bird behaviors are, how they change, and their genetic and physiological basis. In addition, behavior-welfare relations were also revealed.

Keywords: *Well-being, Poultry ethology, Fear, Focal sampling, Behavior*

BEHAVIORAL CHARACTERISTICS IN JAPANESE QUAILS APPLIED TO DIFFERENT MONOCHROMATIC LIGHTING

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Abstract

One of the most important environmental factors for poultry is lighting. Recently, LED lamps have been used in poultry houses due to some of their advantages. The aim of this study is to determine the effects of white (400–760 nm), green (560 nm), yellow (580 nm), blue (480 nm) and red (660 nm) monochromatic lighting treatments on behavioral characteristics of Japanese quails throughout the rearing period. A total of 300 Japanese quails were used in the trial. Observations were made at the ages of four and six weeks. Focal sampling method was applied in order to determine the time budgets for the general behavioral characteristics of eating, walking, drinking water, scratching, mating, standing, shaking, cleaning, pecking, wing stretching, lying, and jumping. In terms of aggressive pecking behavior, the mean of time budget of quails treated with yellow monochromatic lighting was found to be higher than those in other groups. It was determined that quails treated with yellow and red monochromatic lighting were more active, and exhibited more reproductive behaviors, but on the contrary, they showed more unwanted aggressive behaviors. In addition, it was observed that quails with green and blue monochromatic lighting were calmer.

Keywords: *Light wavelength, Poultry behavior, Focal sampling, Environmental conditions*

ENVIRONMENTAL SUSTAINABILITY FOR POULTRY PRODUCTION

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Abstract

Environmentally sustainable production models are one of the most important issues for all production industries. Precautions must be taken today so that human beings can access the resources they need in the future. Various legal regulations are being studied for sustainable production models. The world population is increasing rapidly, while agricultural land and food options for human beings are decreasing. The poultry industry, which is the most important producer of animal protein, will have to make environmental regulations in the near future. Environmental pollution, global warming and carbon emission are the most important environmental problems. The poultry industry, like other animal production areas, causes significant damage to the environment. The biggest environmental problems of the poultry industry can be listed as pollution and wastes in feed raw material production, polluted water and greenhouse gas emissions in production, slaughterhouse residues, poultry residues, hatchery residues. The aim of this study is to evaluate the current situation and offer new suggestions for sustainable poultry production. In particular, there is a need to carry out many studies on obtaining feed raw materials from waste products, and global decision makers and governments need to support these studies.

Keywords: *Sustainability, Industry, Global warming, Green recycle, Carbon footprint*

INVESTIGATION OF THE QUALITY OF FORAGE IN AMASYA REGION IN TURKEY

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Abstract

Roughage has an important role in the nutrition of dairy cattle. The quality of the roughage directly affects of the milk yield and milk components. In Turkey, corn silage, alfalfa, Italian grass, vetch and oat are grown respectively according to the amount of production. In this study, the quality values of forages grown or used in Amasya Region were investigated. The annual average rainfall in Amasya Region is 460.2 mm. For this purpose, 13 roughage qualities obtained from members of Amasya Cattle Breeders Association in Merzifon region (40.871028-35.441747 coordinates) were investigated. These; corn silage, pea-triticale silage, sunflower silage, potato silage, fresh beet pulp, oat grass, Hungarian vetch grass, alfalfa hay, pea-triticale grass, dry beet pulp, cornstalk, wheat straw and peanut shell. The dry matter value of these feeds are respectively; 27.60, 43.30, 24.65, 34.98, 59.80, 94.45, 93.42, 91.73, 90.87, 92.30, 94.05, 92.30, 95.71%; crude protein; 8.64, 16.81, 12.15, 6.81, 10.64, 10.22, 14.54, 15.77, 16.66, 11.48, 3.70, 2.83, 7.06%; neutral detergent fiber; 49.35, 40.83, 41.36, 30.98, 55.00, 49.44, 39.87, 41.17, 51.47, 42.87, 69.09, 72.26, 56.26%, acid detergent fiber; 32.01, 34.63, 36.51, 31.93, 27.35, 30.80, 30.59, 37.48, 33.95, 27.54, 44.19, 49.85, 54.92%. It has been observed that the variety of roughage is high in the region and that quality roughage is produced in sufficient quantities. It has been concluded that the quality of the forage produced by the breeders producing roughage for their own enterprises is the highest, and the quality of the roughage grown in the region is generally high.

Keywords: forage, Turkey.

FIRST RESULTS ON THE HONEY BEE DISEASES IN BOLU PROVINCE, TURKEY

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Abstract

Bolu province has a potential to progress in beekeeping due to its rich flora and vegetation. However, the amount of honey production per beehive in the province of Bolu is 8-10 kg, which is below the average (14.4 kg) of Turkey. In this study, first findings of the presence of pathogens and parasites in bee colonies in Bolu province are presented. For the study, 10 apiaries were sampled in the first step of the study. Three diseases, noseiosis, chalkbrood and stonebrood were the first observed diseases in the examined apiaries. However, noseiosis was the most common disease. It was found in the nine (90%) of the examined apiaries. In contrast, chalkbrood and stonebrood were observed only in one apiary. 137 of the 943 examined bee samples were infected by noseia agents. Infection ranged from 1.1 to 51.4%. Average of the infection was 14.52%. The first results stimulate us to think that pathogens and parasites may be important factors of low yield in honey production in Bolu province, Turkey. However, it is needed to increase the number of apiaries sampled to represent the entire Bolu region, investigate other pathogens and parasites and identify each of them at the species level.

Keywords: *Honey bee, Disease, Noseiosis, Chalkbrood, Stonebrood, Bolu, Turkey.*

INVESTIGATION OF THE EFFECTS OF CALF LOSSES ON THE COUNTRY'S ECONOMY AND LIVESTOCK IN TURKEY

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Abstract

In addition to being an important problem that causes direct losses in dairy cattle farms, calf deaths also cause economic losses. These losses: calf loss, loss of genetic material, financial losses during the treatment, even if the calves recover, they can be expressed as inadequacies in yield performance at advanced ages. Therefore, it negatively affects both the farm and the country's economy in terms of potential meat and milk production. Calf deaths by country are as follows: 25% in Italy, 2.5-7.5% in England, and 6.5% in the USA. This rate has been calculated as 10-15% in Turkey. In this study, the direct and indirect effects of calf deaths on the country's economy, animal wealth and meat-milk production were examined by taking the data of cattle presence in Turkey from TUIK. According to TUIK data, significant increases were observed in the number of cattle between the years 2011-2021. While the total number of calves and calves under the age of 1 was 3,173,820 in 2011, this number increased within 10 years (43.5%) and reached 4,554,322 in 2021. Despite this increase, if there was not a loss of at least 10% on average, this number could have risen to 5.5 million heads, which would have made significant and valuable contributions to the country's economy.

Keywords: *Calf losses, Livestock, Economical losses, Turkey.*

THE EFFECTS OF CONCENTRATE FEED RESTRICTION ON HISTOMORPHOLOGY OF ILEUM OF BROILERS RAISED FREE-RANGE

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Abstract

This study aimed to determine the effects of concentrate feed restriction on the histomorphology of ileum in broiler chickens raised at free range system. Four decares of pasture of clover(*Trifolium repens*), bromegrass(*Bromus inermis*) and Oregano(*Origanum vulgare L.*) was created and surrounded with mobile wires. In the experiment, 480 slow-growing male Hubbard Isa Red-J broiler chicks were divided into 4 main groups and 4 subgroups from each group. Control group was not allowed to graze and fed only with concentrate feed. The concentrate feed intake of the control group was determined daily and this value was used to determine the amount of feed given to other groups next day. 75% of consumed daily feed of control group was given to group 2, 50% to group 3 and 25% to group 4. Group 2, 3 and 4 were allowed to graze 12 hours everyday(7:00am-7:00pm). At the end of the 42nd day of experiment, the average villus height, villus width and the crypt depth of ileum were increased dependent on restriction percentage(P<0.001). All data were higher in group 4 than the others(P<0.001). The thickness of tunica muscularis was higher in group 4 and 2(P<0.001). As a result, concentrate feed restrictions effected the histology of ileum and the most remarkable results of all evaluated parameters were obtained from birds in group 4 compared to the others. Free range grazing on clover, bromegrass and oregano grass improved broiler intestinal histomorphology. More studies are needed to conduct with different forage types on free range systems.

Key words: broiler, free range, histomorphology, ileum, restricted feed.

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MAGGOT DEBRIDEMENT THERAPY IN VETERINARY MEDICINE

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Abstract

Maggot Debridement Treatment (MDT) is known by various names, such as larval therapy and Maggot Debridement Therapy, around the world. It is the use of sterile, live first and second instar larvae of the fly *Lucilia sericata* to treat chronic wounds that do not heal with conventional medical methods. It is used for treatment by taking advantage of the antiphlogistic, antiseptic, antibiotic, and granulation tissue accelerating effects of larval secretions. In recent years, MDT has shown a significant increase in the treatment of chronic wounds in Veterinary Medicine. Larval therapy is a simple, effective, economical, and safe option for the treatment of necrotic, pustular, or gangrenous wounds and ulcers. Larval treatment also prevents weight loss in animals, as well as eliminates milk destruction that occurs with the use of antibiotics. In Veterinary Medicine, MDT has been used to treat actinomycosis in a Guernsey bull; panniculitis and abscesses in donkeys; chronic decubitus wounds in rabbits; foot rot and acute and chronic interdigital dermatitis in sheep; pressure ulcers and gunshot wounds in dogs; and necrotic tumors and multiple bites in cats. It has been used to treat a variety of conditions in horses: chronic laminitis and necrosis in complicated laminitis cases; ingrown nails, foot abscess, chronic and non-healing foot ulcers, foot infection, chronic distal interphalangeal joint sepsis, collateral cartilage necrosis, foot and leg wounds; nail infections and diseases; septic navicular bursitis; osteomyelitis; vasculitis, deep cuts, barbed wire wounds, soft tissue abscesses and wounds, abdominal wounds, and lacerations of the limbs and cancer. MDT has been increasingly used in recent years to prevent amputation and euthanasia of pet animals. The application of larvae to a wound resulting from the amputation of a dog's gangrenous foot and a post-operative infected wound covering the abdominal and inguinal region of cats healed successfully following this treatment.

Key words: *Maggot debridement therapy, Veterinary medicine.*

BREEDING POSSIBILITIES AND CURRENT SITUATION OF ANATOLIAN BUFFALO HUSBANDRY IN BİNGÖL PROVINCE OF TÜRKİYE

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Abstract

The aim of this survey is to emphasize the potential of buffalo husbandry and breeding opportunities in Bingöl province of Türkiye. Animal husbandry in Bingöl province is an important source of income for the local people. It is possible to say that water buffalo husbandry has also shown an improvement considerably in the last five years. In fact, the water buffalo husbandry is indispensable for indigenous people. Since there are many wetlands in the province of Bingöl, one of the most important livestock sectors for this region where the people make their living with animal production is water buffalo breeding. For this reason, buffalo husbandry should be expanded in Bingöl province. In this region, 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. It has been known that breeders perform the water buffalo husbandry in closed housing where they keep cattle and water buffalos together and that they determine the management-feeding requirements of water buffalos according to number of animals. According to the data of 2021, there were a total of 170 head buffalo in Bingöl province. 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. In the province of Bingöl, the water buffalo breeding takes place with a very low share in the livestock production sector in Türkiye. However, the preservation and the development of Anatolian buffalo breed as a genetic source is very important in Bingöl province.

Keywords: *Bingöl province, Buffalo meat, Milk, Water buffalo.*

OVERVIEW OF BREEDERS REGARDING OCCUPATIONAL HEALTH AND SAFETY IN ANIMAL HUSBANDRY IN TÜRKİYE

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Abstract

In this survey study, it is aimed to provide sensitivity of breeders about occupational health and safety and to compile information about occupational safety and accidents that can be encountered by workers at animal production in Türkiye. It is also aimed to provide suggestions for occupational health and safety in animal husbandry. 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 general, possible dangers of workers in the agricultural sector in Türkiye are the ergonomics, the noise, the air conditioning, the chemicals, the pesticides, the animal attacks, the bites, the injuries, the accidents in transport, the psychological stress, and the skin-borne diseases etc. 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. The most common hazards at the animal production in Türkiye 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 etc. 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, the skin and the meat. However, over the past decade, it has been observed that the relevant ministries have put in legal regulations related to the issue. In Türkiye, preventive measures have started to be taken on occupational health and safety in livestock production.

Keywords: *Animal breeders, Occupational accident, Occupational disease, OHS culture.*

TRANSHUMANCE ACTIVITIES AND PROBLEMS IN SMALL RUMINANT HUSBANDRY IN BİNGÖL PROVINCE OF TÜRKİYE

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Abstract

In this survey, the transhumance activities and the problems in small ruminant husbandries in Bingöl province of Türkiye have been discussed. Also, detailed information about highland families in Bingöl 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. In transhumance small ruminant husbandries, sheep flocks are moved to cool highlands with plenty of grassy plains when heat begins to increase and towards the end of spring. The grazing period in animals lasts 3-5 months under the control of shepherds. After weather cools down, highlanders and animals return to villages or to their settlements. Sheep herds usually consist of 300 to 500 heads. The migrants are mostly from Şırnak, Batman, Mardin, and Siirt provinces to the Bingöl 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. Shepherds are taken to the highlands by grazing or by road transport. One of the most important examples of livestock farming is highland small ruminant husbandries in Bingöl province. One of the most important problems of the migrants in the region is undoubtedly related to the education of our children, especially girls, which is emphasized in every platform that is important in the future of the country. 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 Bingöl province economically. Bingöl province has ecological conditions suitable for animal production. If the current potential especially in Bingöl province is evaluated, it can become very important in Eastern Anatolia Region of Türkiye.

Keywords: *Bingöl province, Goat, Nomadic life, Sheep, Transhumance.*

RURAL DEVELOPMENT AND AGRO-ECONOMY

THE POTENTIAL OF AGRICULTURE IN THE RURAL DEVELOPMENT OF THE MUNICIPALITY OF SKENDERAJ IN ALBANIA

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Abstract

This study aims to address the analysis of the potential of agriculture in rural development in the Municipality of Skenderaj, are analysis also the support measures from central institutions through development policies aimed at strengthening rural development, agricultural sectors and livestock farms, sustainable and competitive agriculture. The analysis of direct payments and grants in the agricultural sector performed and the drafting of policies for rural development in Kosovo. The study presents data on agricultural sectors that have had a positive impact on increasing agricultural productivity, improving working conditions and creating new jobs in rural areas. In this study, a series of qualitative, quantitative and action research methods have been prepared through discussions with farmers and desk data research. A secondary analysis of the data was made as well as a comparison in the Municipality of Skenderaj with the data at the national level. The results in this study shows that the Municipality of Skenderaj may have the potential to develop sustainable and competitive agriculture that leads to rural and economic development. The data shows that farms in the Municipality of Skenderaj that are small and very scattered. As well as, on the basis of surveys from the field and the data from the various reports and studies it is concluded that the average of agricultural farms in the Municipality of Skenderaj is 2.36 ha of agricultural land, 2.01 ha of cultivated land, 1.30 and 0.70 ha are meadows, pastures and wasteland, while the average number of plots is 3.20 ha.

Keywords: *Direct Payments, Grants, Rural and Economic Development.*

TECHNICAL AND SANITARY MONITORING OF A BROILER CHICKEN FARM

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Abstract

The development of poultry sectors has improved the consumption of animal protein by the urban population at a lower cost. However, broiler farming faces many problems, including health and pathological problems. Often, these problems are related to the conditions of breeding. Our study focused on a monitoring of broiler breeding for eight weeks, at the poultry complex "ORAC" in the region of Ain-Laloui, Wilaya of Bouira. This sector has experienced a marked growth in recent years within this complex. We have followed a broiler farm with a population of 12,000 subjects from the 30-week-old Hubbard breeding strain. The study that we carried out allowed us to evaluate the zootechnical performance and the hygienic and sanitary parameters of the breeding. Our results reported that the chickens had an average live weight of 2340 grams, and a feed consumption of 162 grams/subject/day, with an average feed conversion ratio of 2.14, and a mortality of 07% during a rearing period of 56 days. These technical results obtained especially on feed consumption, weight gain, feed conversion ratio, diseases and their treatments show that this management of broiler breeding at the level of the breeding complex "ORAC" was satisfactory compared to the standards. However, the mortality rate was high, hence the need to investigate the causes.

Keywords: *Health monitoring, Breeding, Broiler, Zootechnical performance.*

RAINFED CROP PROJECTIONS IN THE SEMI-ARID UNDER SCENARIOS OF PLUVIOMETRIC INSTABILITY IN CEARÁ STATE IN BRAZIL

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Abstract

This paper aimed to analyze the projections of rainfed crops (rice, beans, cassava and corn) in the semi-arid region under scenarios of rainfall instability in Ceará, in the period from 1945 to 2020. The data were collected from the Meteorology and Water Resources Foundation of Ceará (FUNCEME) and the Brazilian Institute of Geography and Statistics (IBGE), through the IBGE System of Automatic Recovery - SIDRA, which provides data on Municipal Agricultural Production (PAM - 2020). The rainfall periods were organized in: drought; normal and rainy. This was done using the historical average and standard deviation of the rainfall from 1945 to 2020. The projections of production variables were made through the Autoregressive Integrated Moving Average (ARIMA) methodology, developed by Box and Jenkins (1976). The results show that the rainfall distribution in Ceará State, between 1945 and 2020, was quite unstable, with the Coefficient of Variation (CV) of the rainfall periods ranging between 33% in normal period to 54% in the drought period. Based on the proposed study we can confirm the general hypothesis, concluding that rainfall has an important impact on rainfed agricultural production in Ceará State, especially in the variables: harvested area, yield and prices of rice, beans and corn crops, interfering in their average and thus influencing the income generation of farmers in the State. In the particular case of cassava, it was possible to conclude that due to the characteristics of its production, where it adapts well to climatic adversities, the interference of rainfall.

Keywords: *Dryland Agriculture, Semi-arid, Forecast, Rainfall Instability, Drought.*

DEVELOPMENT OF BEEKEEPING AND HONEY PRODUCTION AS A RESULT OF THE POLICY MEASURES APPLIED IN BULGARIA AFTER THE MEMBERSHIP TO THE EUROPEAN UNION

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Abstract

The diverse and abundant vegetation in Bulgaria creates excellent conditions for beekeeping. The development of beekeeping in Bulgaria is related to the development of the sector in European countries and in Russia. The first major steps in the development of the sector are the delivery of the first frame beehives in 1884, the establishment of the first beekeeping organization in 1889 and the creation of the first Beekeeping Testing Station with departments in Vidin and Smolyan in 1951. Although Bulgaria occupies 0.08 % of the world's territory, the country provides over 1 % of global honey production and accounts for about 2 % of world trade in bee products. Support to the sector is carried out through the National Beekeeping Program (NBP) as a part of the Common Agricultural Policy of the European Union (EU). NBP, developed with the wide participation and cooperation of beekeeping organizations in accordance with the requirements of European legislation, has a positive impact on the development of the sector. Despite the overall results, the sector continues to need the introduction of new technologies, better control of the health status of bee colonies and measures for solving the issues of personnel training and qualification, protecting bees from diseases and poisoning and promoting the development of bee products. The main objective of the paper is to evaluate the overall impact of the implementation of policy measures targeted to stimulate the beekeeping and honey production in Bulgaria and to identify the main problems faced by the sector.

Keywords: *beekeeping, apiculture sector, honey production, agricultural policy, Bulgaria.*

PEASANT AND NATURE AT THE ONSET OF MODERN FORMS OF FARMING IN CZECH LANDS

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Abstract

Traditional farming in the 19th century is often perceived as an era of farmers who live in harmony with nature. The research questions were: What forms of approach to nature can be identified in the period of the onset of modern forms of farming in the Czech lands? how is this approach interpreted? And how was it shaped? Farming textbooks issued between the years 1820 - 1914 were used for the content analysis. The categories were identified: a) Systematization, calculation, rationalization; b) Modern practices as a yield guarantee; c) Fertilizers - necessity for high production; d) An animal like a machine; e) Machinery as a means of perfect work; f) Science as a higher authority; g) Agriculture as the basis for the welfare of the nation; h) Nature as a subject of adjustment. The partial approaches can be summarized into one. This is the perception of nature as a machine. The approach to nature as an environment of production can be interpreted in the form of modern practices, which began to be used to achieve the highest yields. Implementation of such practices required extensive landscaping and regulation of water elements in the landscape. Understanding nature as the environment of production was formed mainly as a result of abandoning traditional values as they were replaced by science and industry.

Keywords: *Traditional farming, content analysis, Czech Republic, peasant, modernity.*

**SMALL VEGETABLE GROWERS (SVGs) SATISFACTION ABOUT THE
AGRICULTURAL AND EXTENSION SERVICES (EASs) PROVIDED BY PUBLIC
PRIVATE PARTNERSHIPS IN BENI-SUEF GOVERNORATE, EGYPT**

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Abstract

In Egypt, the governmental public and free EASs are facing serious challenges including insufficient budgets and decreasing numbers of village extension workers. Therefore, PPPs represent an appropriate option for providing SVGs, with needed and demanded EASs related to effective production and marketing of the prevailing crops. In addition to SVGs, grouped in Non-Governmental Organizations (NGOs), PPPs involve all relevant stakeholders, including input suppliers, governmental extension workers, and private sector companies. The main objective of this study was to assess SVGs' satisfaction about the EASs provided by 4 PPPs in the area of the production and marketing of some vegetable crops, including onion, green beans, garlic and cucumber. The study was conducted in Beni Suef Governorate, the Nile Valley of Egypt. A sample of 111 SVGs, involved, as members, in four NGOs, were personally interviewed, by using a questionnaire designed for data collection. Medium and high degrees of satisfaction were reported by SVGs concerning: timely provision of EASs, secured marketing of the products, better and improved tools of vegetable production and marketing tools, better relationships among SVGs and governmental workers of agricultural directorates, well training of agricultural workers in post-harvest marketing practices, well training of SVGs on how to produce vegetables according to specifications accepted by consumers in local, regional and international markets.

Key words: *Small Vegetable Growers, Public Private Partnerships, Extension and Advisory Services, Egypt.*

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 campaign 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 in a context of raising global uncertainties.

Keywords: *Food security, Remote sensing, Grains markets, Early warning system, Mediterranean.*

ARE THE CRITICISMS JUSTIFIED?: UNDERSTANDING THE BARRIERS TO DAIRY DEVELOPMENT IN GHANA

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Abstract

The European union is under increasing criticism for its exports of dairy products to developing nations. Claims are that dairy exports, especially cheap milk powder, hinders growth of the dairy sectors of recipient nations. Ghana is one of the countries that imports more dairy products yearly than it produces. In this regard, we undertake this study to identify and analyze the barriers contributing to the demand-local supply gap using primary data collected from 34 actors along the local fresh milk and milk powder value chains. The data gathered was analyzed descriptively. As our study reveal, beef production instead of milk is the objective of cattle farmers in Ghana. Also, dairy products processed domestically are almost exclusively made from imported milk powder. Moreover, the local milk value chain is informal, underdeveloped and adds minimal value to fresh milk compared to the value chain of imported milk powder. Local products sold on the Ghanaian markets do not undergo any form of safety tests and are not certified. We identify a host of challenges along the local milk value chain that contribute to explain better its poor state. For critics, a ban on imports would be the ideal solution. However, our analysis highlights the importance of imported dairy products for a steady supply and accessibility to dairy products. Furthermore, the domestic processing industry which offers many jobs to Ghanaians would not exist without milk powder. Notwithstanding, local dairy products are on high demand and for that matter its value chain should be upgraded.

Keywords: *barriers, dairy, local milk, value chain, Ghana*

BECOMING REFLECTIVE PROJECT PARTNERS: A FRAMEWORK TO IMPLEMENT INDIVIDUAL REFLECTION IN A MULTI-ACTOR PROJECT

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Abstract

Research practice and funding programmes in the European Union (EU) are increasingly turning to multi-actor approaches as a promising solution to address the complex challenges in agriculture and rural areas. Within this context, several studies highlight reflection and learning as key dimensions of the multi-actor process. Their relevance is of two levels: first, the development of individual competencies, that includes knowledge, skills, and capacities and second, social learning, whereby involved actors through interaction develop new knowledge and trust as a basis for joint action. Both levels of learning are important but an exploratory review of the literature shows that rarely is any attention given to the individual level of learning. This study particularly addresses this knowledge gap. We explore how individual learning can be supported and facilitated in the context of an ongoing EU multi-actor project that aims to support advisors to boost interactive innovation in agriculture and forestry. The research method consisted of action research cycles, where we developed, tested, and implemented a structured approach to support project partners in reflecting on their learnings in the project. The presented results highlight how reflection, as an organised practice, can be enabled by tools and processes. The framework and reflection tool introduced, can guide a systematic reflective practice in other multi-actor projects.

Keywords: *Multi-actor approach, learning, reflection.*

ATTITUDES ON SOCIAL SOLIDARITY ECONOMY IN A REGIONAL CONTEXT: CASE OF THE REGION OF WESTERN MACEDONIA IN GREECE

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Abstract

Government policies have strengthened entrepreneurship in a variety of ways by addressing the negative factors of the last decade such as economic distress, the banking crisis and the pandemic. People, by creating new businesses or producing innovative products, are in turn coping with these circumstances. In this environment, efforts are being made to restore cooperative entrepreneurship to a new and more flexible form, appropriate to the conditions of the current era. The social economy is essential and holds an important place in the business world. Cooperative organisations create new jobs and employ people belonging to socially vulnerable groups. They also provide benefits to their members, to the local community and their achievements support areas remote from major urban centres. The Region of Western Macedonia in Greece, due to de-lignification, was marked by unemployment and economic decline, and as a result, the attitudes and opinions of citizens regarding the forms of Social Economy were explored in this paper. It is for this reason that the region was chosen as the field of research, and the survey was conducted in 2021. According to the findings of the survey, most citizens of the Region of Western Macedonia do not know what a Social Cooperative Enterprise is, unlike other forms of cooperative organizations that are more popular and well-known in the region. Whereas, the majority thinks the benefits that the Social Economy offers to its members and to the local community, such as the introduction of innovations and price stability in supplies and products, contribute dynamically to local economic development.

Keywords: *Cooperative Organizations, Women's Cooperatives, Social Cooperative Enterprise, Entrepreneurship.*

RELAUNCH AND PROMOTION OF THE COFFEE SECTOR IN THE TOWN OF GROS-MORNE IN HAITI

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Abstract

The article "Revival and promotion of the coffee sector in the commune of Gros-Morne" focuses on the axis of agricultural development in relation to the difficult and precarious situation in Haiti. This "Relaunch and enhancement of the coffee sector in the municipality of Gros-Morne" project, also called REVACA - I, will take place over a period of 3 years, renewable. Through this project, we intend to support a number of 200 beneficiaries who will be distributed in localities like Beaumont, Treille and Corail (Acul / Rivière Blanche, respectively 4th and 3rd communal section). On the technical side, we envisage a production of 120,000 seedlings of coffee trees with the planting of 100,000 seedlings and 20,000 other cover seedlings. We are also planning other crosscutting activities aimed at setting up intercropping crops that can generate income quickly, training sessions on the importance and need for reforestation, but also training sessions in entrepreneurial management in front of allow beneficiaries to manage their operations well. The budget planned and requested for the smooth running of all activities is \$ 1,171,040.40. It is for this purpose, this budget points this amount for an insightful and scientific achievement. Finally, the resolution on the agricultural sector is a large-scale field to allow a contribution towards research axes in agriculture.

Keywords: Coffee, promotion, Haiti.

MORPHOTAXONICAL INVESTIGATION OF FESTUCA TAXA ACCORDING TO HORTICULTURAL APPLICABILITY

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Abstract

During this survey, two potentially horticulturally usable *Festuca* species were analysed: *Festuca wagneri* and *Festuca tomanii*. The main questions were the following: are they usable in an urban environment? Specimens of the two taxa, which were planted either into normal garden soil or into pots differed greatly. 30 specimens of each taxa were planted into similar environment for the sake of taxonomic and morphologic analyses. *Festuca tomanii* specimens were uniform, but *Festuca wagneri* formed clearly distinguishable taxonomic groups. Specimens of *Festuca tomanii* were usually larger and more uniform. Though the average lengths of leaves and inflorescence stems tended to be higher on the soil mixed with perlite, the coverage values were lower on it. Several types were selected from them, which could be useful in horticultural practice. These were named and described as such: 1. leaves and inflorescences both stand up densely; 2. generative shoots bend apart; 3. dense but short „dwarves”; 4. Very tall with spreading inflorescence with a particular lilac, antocianic colour on the nodes. These groups were expanded with the colour of the specimens, so green, grayish and silvery variants can also be separated. The tissue differences were in line with their horticultural decorative values and the differences in the inflorescence parameters. The diversity of *Festuca wagneri* showed well in this survey, and these taxonomic parameters would be also useful in horticultural practice. The survey was supported by OTKA K-125423.

Keywords: *Festuca wagneri*, *F. tomanii*, tissue

OBSTACLES FOR SOCIETAL PARTICIPATION OF RURAL WOMEN IN DUHOK GOVERNORATE IN KURDISTAN REGION OF IRAQ AND ITS RELATION WITH SOME VARIABLES

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Abstract

Women play a vital role in economic activities. They comprise about 50% of the total global labor engaged in agriculture and food production enterprises. This study is designed to determine the economic participation by rural women in Duhok governorate in Kurdistan Region of Iraq. The number of the respondents in this study was (474) selected by area random sampling. SPSS software was used to analyze the data collected, statistics such as frequency, percentage, mean, standard deviation, correlation, and regression was used. The results shows that the perception level of respondents in economic participation is high. The obstacle facing women in agricultural extension activates, thus the biggest obstacle is “Women training need courses in agricultural fields”. The social obstacle of (The prevailing social norms and traditions limit the participation of women in community work) is ranked first, the economic obstacle of (High unemployment rates) is ranked first. The results also show there is a significant relationship between some social, demographic variables and ‘economic participation level such as age, number of study years, satisfaction with services in the villages, urban openness and with non-significant living conditions of the family, fathers’ occupation or guardian, current job, ability to solve problems. It is recommended that the extension agencies should have a re-orientation of their Programs and activities, where women will be treated equally with their male counterparts. This will ensure more rural and agricultural development in the targeted area.

Keywords: *Rural women, participation, Obstacles, Duhok.*

AGRO-BIODIVERSITY IN NATIONAL PATHWAYS FOR FOOD SYSTEM TRANSFORMATION: CASE OF WEST AFRICA

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Abstract

The challenges relating to biodiversity loss, food insecurity and climate change show the urgent need to make transition towards sustainable food systems in West Africa. To bring about such a transition worldwide, the United Nations' Food Systems Summit was held in September 2021. One of the main outcomes of the Summit was the national pathways to sustainable food systems. This review analyses whether and how agro-biodiversity is addressed in the food system transformation pathways submitted by West African countries in the framework of the Summit. The content analysis suggests that agro-biodiversity is not a central topic in the national transformation pathways. In fact, it is completely overlooked in some pathways documents, and rather marginal in others. Some national documents (cf. Burkina Faso, Ghana, Niger, Nigeria) refer to the promotion of the diversity of crops and farm animals as a means of adapting to climate change, improving livelihoods and diversifying diets thus contributing to nutrition security. Moreover, only a few measures and actions dealing with the valorisation of the neglected and underutilised species (NUS) and traditional crop varieties are included in the national transformation pathways (cf. Guinea, Liberia, Niger, Sierra Leone). The conservation, management and restoration of agro-biodiversity and agro-ecosystems are crucial to boost the transition towards nature-positive food systems in the region. Therefore, a paradigm change is needed in policy, research and practice to conserve the natural resource base and contribute to sustainable development by addressing, inter alia, food insecurity and malnutrition, rural poverty and climate change challenges.

Keywords: *biodiversity conservation, nature-based solutions, Food Systems Summit, orphan crops, transition pathways.*

SUSTAINABILITY OF NEGLECTED AND UNDERUTILISED SPECIES (NUS): TOWARDS AN ASSESSMENT MATRIX FOR CROP SPECIES

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Abstract

Neglected and underutilised species (NUS) are widely claimed to contribute to sustainability and sustainable development. Verifying such a claim implies the use of a scientifically sound assessment tool. In this context, the present article aims to suggest a matrix for the assessment of the environmental, economic and social sustainability of NUS. In particular, the paper provides a set of indicators and metrics to assess the different sustainability dimensions. It draws upon a search carried out on the Web of Science in May 2022 that returned 126 records. Eligible documents underwent two steps: in the first step, indicators, metrics and criteria regarding sustainability were identified; in the second step, expert knowledge was used to systematise the identified indicators and metrics according to the three sustainability dimensions and group them into themes. Agronomic aspects were included in the environmental dimension while nutrition, health and cultural aspects were included in the social dimension. One of the main results of the analysis is that there is a dearth of quality scholarly documents dealing with the assessment of NUS sustainability. Furthermore, economic and social indicators and metrics are hard to find. The operationalisation of the proposed indicators requires their contextualisation taking into consideration the conditions in each country/territory as well as the NUS concerned. A further important step to operationalise the proposed matrix implies the identification of a sustainability threshold and an assessment scale for each indicator. Apart from sustainability assessment, the proposed assessment matrix can allow selecting the NUS that have the highest potential and whose promotion can contribute to the sustainable development of the concerned countries and territories.

Keywords: *orphan crops, environmental sustainability, economic sustainability, social sustainability, sustainability assessment.*

NEGLECTED AND UNDERUTILISED SPECIES (NUS): AN ANALYSIS OF STRENGTHS, WEAKNESSES, OPPORTUNITIES AND THREATS (SWOT)

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Abstract

Despite the growing attention to the neglected and underutilised species (NUS) as a valid instrument to promote not only sustainable agriculture and food systems but also sustainable development in rural areas, attempts to move from good intentions to effective actions have been limited. This is due, among others, to a gap in knowledge about the myriads of existing NUS and their potential. In this context, the present paper provides a comprehensive analysis of the strengths, weaknesses, opportunities and threats (SWOT) of crop NUS. Data for the SWOT analysis were retrieved through a review of the literature carried out in June 2022 on the Web of Science. Strengths relate, inter alia, to adaptability to harsh, marginal conditions, tolerance to biotic and abiotic stresses (e.g. pests and diseases, drought) and low external input requirements of NUS as well as their high medicinal and nutritional values combined with widespread culinary traditions. Weaknesses regard low productivity as well as difficult access to quality seeds, inputs, technologies and knowledge. Higher demand from consumers as well as increasing attention to sustainability and resilience in the whole agri-food system and agroecology represent opportunities for the promotion of NUS to address challenges such as food and nutrition insecurity and poverty. Climate change, biodiversity loss and genetic erosion, land and agroecosystem degradation, loss of traditional knowledge and heritage, and competition from commercial crops are among the main threats to NUS. The SWOT of NUS outlined in this work should inform evidence-based policies and strategies for the promotion of NUS, especially in developing countries. They should also guide the undertakings and actions of all stakeholders interested in the development of NUS value chains.

Keywords: *orphan crops, NUS, SWOT analysis, sustainable agriculture, rural development.*

URBAN AND PERI-URBAN AGRICULTURE IN BURKINA FASO AND NIGER: A BIBLIOMETRIC ANALYSIS

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Abstract

Urban and peri-urban agriculture (UPA) has been recently put forward as a means to address many challenges such as food insecurity, climate change and poverty. This is particularly relevant in developing countries, facing the dramatic consequences of these challenges, such as Burkina Faso and Niger in Sahelian West Africa. Research is needed for the development of UPA. However, comprehensive analyses about the landscape of research dealing with UPA are oftentimes lacking especially in developing countries. In this context, the present review provides a bibliometric analysis of the scholarly literature addressing UPA in Burkina Faso and Niger. It draws upon a search performed in June 2022 on the Web of Science. The bibliometric analysis focuses on sources/journals, research areas, authors and organisations/affiliations. It suggests that while interest in research on UPA is increasing, the annual output of articles remains low. Furthermore, the research field is quite multidisciplinary but mainly falls under the area of agriculture thus focusing on biological and environmental sciences, while social sciences and economics are generally overlooked. The analysis also shows that a large share of studies on UPA is carried out by scholars affiliated with universities and research centres based outside Burkina Faso/Niger and even West Africa, especially in Germany. This might denote the weakness of the research system and the lack of structured research projects/programs on UPA in both countries. Investments in research, development and innovation are needed to bridge the existing knowledge gap and unlock the potential of UPA in addressing the challenges that both countries face. Since challenges and opportunities are quite similar, multi-country and regional research programmes on UPA would be highly beneficial in the Sahel and West Africa.

Keywords: *urban agriculture, urban food systems, Sahel, West Africa, bibliometrics*

AGRO-BIODIVERSITY IN NATIONAL PATHWAYS FOR FOOD SYSTEM TRANSFORMATION: CASE OF WEST AFRICA

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Abstract

The challenges relating to biodiversity loss, food insecurity and climate change show the urgent need to make transition towards sustainable food systems in West Africa. To bring about such a transition worldwide, the United Nations' Food Systems Summit was held in September 2021. One of the main outcomes of the Summit was the national pathways to sustainable food systems. This review analyses whether and how agro-biodiversity is addressed in the food system transformation pathways submitted by West African countries in the framework of the Summit. The content analysis suggests that agro-biodiversity is not a central topic in the national transformation pathways. In fact, it is completely overlooked in some pathways documents, and rather marginal in others. Some national documents (cf. Burkina Faso, Ghana, Niger, Nigeria) refer to the promotion of the diversity of crops and farm animals as a means of adapting to climate change, improving livelihoods and diversifying diets thus contributing to nutrition security. Moreover, only a few measures and actions dealing with the valorisation of the neglected and underutilised species (NUS) and traditional crop varieties are included in the national transformation pathways (cf. Guinea, Liberia, Niger, Sierra Leone). The conservation, management and restoration of agro-biodiversity and agro-ecosystems are crucial to boost the transition towards nature-positive food systems in the region. Therefore, a paradigm change is needed in policy, research and practice to conserve the natural resource base and contribute to sustainable development by addressing, inter alia, food insecurity and malnutrition, rural poverty and climate change challenges.

Keywords: *biodiversity conservation, nature-based solutions, Food Systems Summit, orphan crops, transition pathways.*

INFLUENCE OF THE ECONOMIC CRISIS TO THE PRODUCTION PRICE OF WINE GRAPES IN THE REPUBLIC OF NORTH MACEDONIA

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Abstract

The grape production together with the wine industry contributes about 20% of the total agricultural GDP in the Republic of North Macedonia and occupation of around 30,000 rural households. Due to the Covid-19 pandemic crisis and the instability of the world situation, the prices of raw materials in agricultural production are constantly increasing. Hence, the main goal of this paper is to assess the impact of the global economic crisis on the production price of wine grape varieties. The main approach of the comparative analysis for the production prices between the reference years 2020 & 2021 and estimated 2022 is based on established normative calculations of grapes within the Institute of Agriculture. The total costs are calculated based on variable and fixed costs of grape production. The investment and inputs costs are collected by commercial companies, suppliers of raw materials and farmers. The findings demonstrate that the average production price of grapes at total costs for 2020 & 2021 accounts in average 0.30 EUR/kg. The results from the estimations of the production price of grapes for 2022 show increase by 20%, which implies that the economic crisis has a large impact on the viticulture and wine industry. It is anticipated that the socio-economic situation of grape producers will be negatively affected. Therefore, the public policies for development of this important sector for the Macedonian agriculture should correspond to the new situation.

Keywords: *socioeconomic situation, world crisis, wine grapes, production price.*

IMPROVING RURAL DEVELOPMENT THROUGH EDUCATION

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Abstract

Introduction. México has presented low average annual yields range at orange production the last years of $13.06 \text{ t}\cdot\text{ha}^{-1}$. In other countries, this amount has dropped as low as $29 \text{ t}\cdot\text{ha}^{-1}$. It is considered that the low citrus yields in Mexico may be due to the low number of innovations adopted by citrus growers, averaging only 15%. It is indicated that extension systems goods are required for the adoption of innovations and the development of networks. These systems must be relevant, effective, sustainable, and must generate competitiveness through the improvement of these processes. There are several extension systems, for example, the technological innovation network, or andragogic. Methodology. A total of 150 participants were identified for this study, of five communities and those who wanted to be involved in the program. The citrus growers who accepted to participate in the project owned land space of 1 to 10 hectares, with annual production costs of 150 USD per hectare. Result. In relation to use of forage soybeans, there was an increment of 90 %. 30 % of producer use organic product and there was also an increase of incomes of 31.3% for 2022, in relation to the 2012 survey, which was statistically different. For 2022, there was an increase in income of 454%. This is possibly the result of the producers adopting 65% the technological innovations proposed through the implemented andragogic extensionism and the advance in the consolidation of groups and the increase in the price of the products.

Keywords: *Education, Incomes, citrus, andragogic.*

MONTENEGRO WINE PRODUCTION AND EXPORT ANALYSIS

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Abstract

Montenegro has a long tradition in grapes and wine production. Having in mind technology development in wine production, the question is no longer how to produce, but how and where to market it. Therefore, wine market research is gaining more importance. The subject of this paper is Montenegro wine production and export analysis. Additionally, the paper shall present data on grapes and wine production in Montenegro in reference to trends observed in previous years as well as export results and its share in foreign trade exchange. The objective of this paper is to research and show the importance of quality improvement in wine production and marketing in foreign markets which, apart from good results, would contribute to the development of the country. Data presented in the paper show growth tendency year after year in wine production. Considering that wine is traditionally one of most important agricultural export products of Montenegro which have been registering for years the significant foreign trade exchange surplus as well as considerable share in overall export of agricultural products, it is necessary to analyze factors of modest representation of Montenegrin wines in foreign markets in comparison to other leading countries with the objective to increase Montenegrin wine share. Investments in production, quality product and more wine marketing would lead to better positioning and increase of competitiveness of domestic wine.

Keywords: *export, production, agriculture, wine marketing.*

DEVELOP FISH FARMING TO SAVE AGRICULTURE

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Abstract

Fish farming is the farming of fish, in fresh, brackish or salt water. This branch of aquaculture fulfills an essential dual function for food security. In addition to the breeding of fish products that can be used for human food, fish farming contributes greatly to the preservation of the water in the dam, in particular by combating eutrophication due to the sharp increase in nitrogen and phosphorus discharges linked to human activity. As an alternative to the chemical and biological solution, fish farming makes it possible to safeguard better quality water for irrigation and watering of fields and to fight against the proliferation of macrophytes in irrigation canals by means of Chinese carp breeding these are used to devour harmful plants in the waters of the dam to fight against aquatic plants. In this perspective, more than 1, 700,000 Chinese carp have been introduced into the main Moroccan dams, including the Idriss I dam, which was filled in 1973 to serve the irrigated plains downstream. Biological control agents are increasingly seen as a preferable alternative to traditional methods (chemical and manual/mechanical control) which are becoming increasingly expensive and impractical. However, fish farming comes up against serious limitations such as fluctuations in the oxygen content, day and night, due to a strong proliferation of aquatic plants. This paper attempts an evaluation of the experience of fish farming in the Idriss first dam located in the Fez-Meknes region to consolidate the achievements and correct the shortcomings and failures.

Key words: *Fish farming, eutrophication, Idriss first dam, food security*

AGRICULTURAL DEVELOPMENT AS AN INTERFAITH BRIDGE IN MOROCCO

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Abstract

Indeed, the Moroccan Jewish community can assist farming communities of the nation in generating and planting the billions of fruit and forestry trees they need. But shifting from pilot projects to a wide-scale level had to address several community concerns. For example, some families worried about the risk involved in agroforestry, such as losing land if the crops could not produce a sufficient return. The solution was to use donated land for growing saplings to a viable degree. Much of this land is used for nurseries, donated from the Jewish community and from the High Commission of Water and Forests and the Fight against Desertification. As of 2022, this ongoing project plants more than 2 million seeds per season, in HAF's community nurseries. On January 17, 2022, the organization's annual National Planting Day event, coinciding with Martin Luther King, Jr.'s Birthday and the Jewish festival Tu Bishvat (the New Year of the Trees), continued to promote environmental and cultural awareness by planting trees at over 40 communities and schools around the country. Morocco's continued dedication to preserve the Jewish cemeteries throughout the country presents a major opportunity to build the people's tree nurseries alongside this cultural preservation effort. The nurseries inspire dedication to local participation in the long-term sustainability of the cultural efforts, while the interfaith initiatives are ushering this vast human development and environmental enhancement opportunity in the form of tree nurseries. Their integration and mutual reinforcement are now, through the successful pilot initiatives, a particularly Moroccan experience that is certainly relevant and replicable in nations of the world that seek agricultural development as a key measure for eradicating poverty along with dedication to the fulfillment of possibilities enabled by multicultural community and national identities. Morocco is at a crossroads in regard to existing opportunities for interfaith initiatives as the number of Jewish Moroccans still living in the nation has dwindled to fewer than 3,000. Those who can still recall the time of mutual understanding and cohabitation must participate in development initiatives now before it is too late. Today's youth have rarely had the opportunity to sincerely consider this indelible part of the nation's past and character, and how that past could inform its present and its future. The nonprofit associations involved are dedicated to promoting and preserving Moroccan Jewish heritage, to strengthening society's plural identity, and to furthering sustainable development in Morocco. Cultural and site preservation, multicultural dialogue, and knowledge-building by these associations is harnessing the exceptional history of the Moroccan people and using it for human development initiatives. Organic fruit tree nurseries benefiting Moroccan farming families, built on land lent in-kind by the Moroccan Jewish community, next to Jewish cemeteries and saints' tombs, symbolize a powerful and essential national initiative. Since Morocco shares all of the biozones represented in the MENA region, these initiatives have implications reaching beyond Morocco where there is diversity of identities and environmental viability.

Key words: agriculture, Morocco.

EVALUATION OF SELECTED APICULTURAL PRACTICES IN COMBATING CLIMATE CHANGE ON PRODUCTION OF HONEY

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Abstract

This study was conducted to evaluate selected apicultural practices on honey production with a view to combating effect of climate change in honey production. The overall objective was to establish best practices for the improvement in honey production. The work was carried out at the Olusegun Agagu University of Science and Technology, Agroforestry Unit). The apiary layout was carried out on a primary forest within bees' friendly environment and hives were installed at 10x10 m . 50 beehives of Kenya top bar hives and frame hives were installed on an acre of farm land. The apiary was laid in a Randomized Complete Block Designed and replicated three times. The treatment combination consists of five different baiting materials and provision of water during the dry season . Data were analyzed using descriptive statistics and ANOVA. The results showed average comb yield (acy top bar 12kg), frame hive pure honey yield (17kg,) average wax yield (2.5 kg), average total revenue per hive (15 thousand Naira). However, the provision of additional water source reduced the rate of absconding during the dry season, However, provision of additional honey food two months after colonization enhanced the yield of the honey and dryness of combs. Significant differences ($P < 0.05$) exist between the rate of productivity of top bar hives and framed hives. It is recommended that additional source of water must be provided within the apiary as this will reduce the rate of bees abscondement and dryness of combs.

Key words: *Apicultural practices, honey production, climate change, environment.*

EFFECTS OF CLIMATE CHANGE AMONG ARABLE CROP FARMERS IN SAVANNA ZONE OF OYO STATE NIGERIA

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Abstract

This study is designed to examine the extent of the effects of climate change among arable crop farmers in the savanna zone of Oyo state, Nigeria with a view to providing measures to prevent the effects of climate change on arable crop production in the study area. Specifically, the study identified the perceived effects of climate change among arable crop farmers, described arable crop farmers' personal characteristics and determined appropriate measures to prevent the effect of climate change. Multistage sampling techniques were employed to select 170 arable crop farmers in the savanna zone of Oyo state. Data were collected through the use of validated structured interview schedule. Analysis was done through the use frequency distribution, and person product moment correlation (PPMC) was used to test the hypothesis formulated. The results showed that majority (75%) of the arable crop farmers were male with mean age of 38 years. The average years of farming experience was 25.5. The perceived effects of climate change among arable crop farmers revealed decrease in crop yield, reduction quality of crop and loss of arable to seasonal wild fire. There are also positive and significant correlation between the effects of climate change and selected personal characteristics of farmers namely income (0.26) labour size (0.176) functional contact with extension agents (0.184), farm size (0.328) at $P < 0.05$. However, the study revealed that the effects of climate change were attributed to factor like dependence on rain fed farming. The study recommends measures such as introduction of supplemental irrigation to cushion climate change effects among arable crop farmers.

Keywords: *Arable crops, climate change, wild fire, irrigation.*

ECONOMIC ANALYSIS OF PINEAPPLE PRODUCTION IN EDO SOUTH AGRO-ECOLOGICAL ZONE, EDO STATE, NIGERIA

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Abstract

This study used descriptive statistics, budgetary analysis, regression analysis, Marginal value product (MVP) index and Likert Scale to analyze data collected from 120 pineapple farmers to examine the Economic Analysis of Pineapple Production in Edo South Agro-Ecological Zone, Edo State, Nigeria. The study showed pineapple production was a male dominated activity with 87.5% of respondents married. The mean household size of respondents was five persons per household and mean age of respondents was 49 years with 98.3% of the respondents having one form or the other of education. The average years of respondents in pineapple production stood at 17.7 years. About 85.8% of respondents had extension agents visit their farm in the farming season under review. Yield was 26,187kg of pineapple for every 3.7 hectares by incurring a cost of NGN 971,198.11. Revenue accrued for a planting season was NGN 5,526,479.17 with a gross margin of NGN 4,555,281.06 and Net profit of NGN 4,491,112.96. Return on investments was found to be 4.3. Pineapple production is very profitable in the study area. All inputs used for production were underutilized. Inadequate and insufficient labour, financing and farmland were some of the constraints to pineapple production in the area. It is recommended that the constraints should be addressed by those concerned and to set up pineapple processing facilities in the area to create room exploration of the pineapple value chain and to prevent post harvest losses and optimize production.

Keywords: *Pineapple, Profitability, Efficiency, Regression, Constraints.*

FOOD EXPENDITURE PATTERN OF HOUSEHOLD IN DELTA STATE, NIGERIA: ECONOMIC RATIONALITY ESSENTIALS

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Abstract

Parametric utility model that predicts preferences of heterogeneous food consumers is flawed with issues of economic rationality. Using axiomatic preference indexes on food data from 174 household selected from a three-stage sampling procedure, the study examined rationalizability of household food preferences in Delta State. The study found heterogeneity in food consumption behaviour with evidence against rationality in utility maximization for food expenditure choice at Afriat Efficiency Index (AEI) of unity, violating the GARP, SARP, SGARP, HARP and CM outside the optimum AEI of between 0.536 and 0.982 inclusive. In three of the four food choice categories, households had below the Varian AEI threshold of 0.95. Particularly, household expenditure behavior in the State violated the GARP axiom of revealed preference at 0.018, 0.07, 0.104, 0.05, and 0.081 severity of violations for food in general, protein, carbohydrate, fats and oil, and fruits and vegetables sub-food categories respectively with 5-45% of inconsistent household behaviour. At AEI of unity, 14.30%, 4.79%, 11.43% and 45.04% of the households failed the zero tolerance in the carbohydrate, protein, fats and oil, and fruits and vegetables categories respectively. Only about three to six revealed preferences were found necessary to fully rationalise observed food expenditure choices in the State. Thus, not only are households irrational in utility maximization, there is unstable preference in food demand. Also, there is, in the aggregate, no one continuous, strictly increasing, piecewise strictly concave, skew-symmetric, and/or homothetic preference function that would completely rationalize households food consumption behavior in Delta state.

Keywords: *preferences, AEI, GARP, SARP, SGARP, HARP, CM*

PROMOTING DIVERSIFICATION AND FOOD SAFETY IN LOCAL VALUE CHAINS: THE CASE OF FRUITS IN OMATE VALLEY, PERU

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Abstract

In the Omate Valley, which is located in the department of Moquegua in Peru, there are two important food products that boost the local economy: sweet lime (*Citrus limetta*) and avocado (*Persea americana* Mill.). However, food diversification strategies are neglected in spite of their potential effectiveness. For this reason, the objective of this research was the physicochemical characterization and fatty acid composition of oil extracted from sweet lime peel and two varieties of avocado (Hass and Fuerte). Additionally, the content of cadmium, lead, and arsenic were measured using atomic absorption spectrophotometry. The results show that the essential oil of the sweet lime peel contains D-limonene (56.57 %) and β -pinene (15.14 %) as major compounds in the volatiles. Fuerte avocado oil contains 77.43 % monounsaturated fatty acids, 8.54 % polyunsaturated fatty acids, 73.87 % Omega 9, 8 % Omega 6 and oxidative stability during 3.5 years. Hass avocado oil contains 71.47 % monounsaturated fatty acids, 13.39 % polyunsaturated fatty acids, 66.37 % Omega 9, 12.64 % Omega 6, 0.7 % Omega 3 and oxidative stability during 4 years. The concentrations of lead, arsenic, and cadmium did not exceed the corresponding national standards and were lower than 0.038 mg/kg, 0.100 mg/kg and 0.010 mg/kg, respectively. Thus, they are safe foods, and given the high nutritional content to consumers, this study suggest that Omate Valley has great potential to develop and add value to its fruits products, for instance, through geographical indications or distinctive signs.

Keywords: *Heavy metals, Atomic absorption spectroscopy, Sweet lime, Avocado oil, Essential oils.*

ESTIMATING THE MAGNITUDE OF FOOD LOSSES AND WASTE GENERATED IN PERU

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Abstract

The last decade has witnessed a rapidly growing number of studies on the quantification of food loss and waste (FLW) in various regions around the globe, but little work has been done to have food waste data in Latin American countries. This paper contributes to addressing this knowledge gap by examining the magnitude of FLW along the whole food supply chain (FSC) in Peru. The methodological approach was based on the top-down mass flow analysis at all steps of the FSC for the 2007–2017 period, including different food commodity groups (CGs), such as cereals, roots and tubers, oil seeds and pulses, fruits, vegetables, meat, fish and seafood, and milk. Results show an annual average of FLW of 12.8 million tonnes, which represents 47.76% of the national food supply. Regarding per capita quantities, the average amount of FLW was 426.56 kg per year when considering the entire FSC, and 67.34 kg per year when considering only the consumption step. This study suggests which steps of the FSC and CGs are the most promising targets for FLW reduction strategies in Peru.

Keywords: *Food security, Food policy, Food supply chain, Organic waste, Latin America.*

HOW DID FOOD SAFETY KNOWLEDGE, ATTITUDES, AND PRACTICES IN BOSNIA-HERZEGOVINA EVOLVE AFTER TWO YEARS OF COVID-19?

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Abstract

COVID-19 has influenced consumers' diet and food preparation activities, food safety knowledge and attitude, and food shopping habits. Given the several changes in everyday life, it is expected that consumers' attitudes about food and food safety have also shifted. Though food safety is a collective responsibility, individual consumers and food handlers may play a significant role in avoiding foodborne diseases. Further, many of the behavioral changes during the pandemic might be attributable to shifts in consumer perceptions of risk. Worries about the virus living on food and surfaces and the fear of getting the virus may motivate consumers to go above and beyond recommended measures. Some people nevertheless felt compelled to take high-risk measures to protect against COVID-19, such as applying cleaning or disinfecting products to their skin or washing food with disinfectants. Indeed, several myths and disinformation regarding COVID-19 and food safety have been communicated through social media, making it critical for governments and specialists to combat the pandemic and the "infodemic". During a public health crisis, consumers' trust may determine whether they follow food safety recommendations from specific sources or entities. According to a previous study conducted in Bosnia and Herzegovina, consumers' eating, shopping, and interaction with food changed during the first wave. Hence, this paper aims to assess how, two years after the onset of the COVID-19 pandemic, food safety knowledge, attitudes, and behaviors evolved among adult consumers in Bosnia. To the best of our knowledge, this might be the first research of its sort in Bosnia and Herzegovina and the whole Balkans region.

Keywords: *Food safety; knowledge, attitude and practice; COVID-19; Omicron; Bosnia and Herzegovina; Balkans.*

HOW GREEN IS RURAL TOURISM? AN INVESTIGATION AMONG RURAL TOURISM OPERATORS IN ROMANIA

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Abstract

Rural tourism is one of the most important types of tourism, both in terms of tourist arrivals and tourism receipts, and considering its social, economic, cultural and environmental impact over the nature and the local community. Being usually associated with a more environmentally friendly approach, rural tourism is very diverse in terms of activities, attractions facilities, but also type of providers and operational structures. In this paper we are investigating the adoption of green practices by economic agents operating in rural tourism and hospitality. In order to achieve this aim, we have conducted an online survey among Romanian rural tourism operators during February-March 2022. The main issues investigated have addressed the following issues: use of green energy; solid and liquid waste management; air quality; green buildings and design. For every research question a number of five attributes were defined and a five-point Likert scale was used to measure the extension of green practices adoption. Our findings are important to policy makers, who are striving to design policies and use financial and economic instruments to foster the "greening" of tourism practices and help small ventures operating in tourism and hospitality to act more environmentally responsible. The final aim of both operators, local communities and governmental policies should be adopting more eco-friendly practices in the benefit of all stakeholders.

Keywords: *Rural tourism, Green practices, Online survey, Romania.*

IMPROVEMENT OF RURAL TERRITORIES IN THE VOLOGDA REGION

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Abstract

Creation and improvement of a comfortable, environmentally friendly and aesthetically rich environment of tourist areas is of great importance both in large cities and rural areas. The paper aims at the development of a project for the improvement and landscaping of the Kupechesky Dvorik public territory in Ustye village (Vologda region, the Russian Federation). Ustye village is a tourist center of the region, so it is important to create an attractive image of the city for tourists. In the course of work, the improvement and landscaping of a public territory was conducted; an assortment of trees, shrubs and herbaceous vegetation was selected; trees and shrubs were planted as long as a lawn and flowerbeds. In accordance with the developed project, *Thuja occidentalis* 'Brabant' was planted in a row along the building adjacent to the House of the Merchant Nikulichev; an ordinary garden lawn was created from the grass mixture of *Festuca rubra*, *Festuca pratensis* and *Poa pratensis* between the House of the Merchant Nikulichev and its fence. According to the project, on the territory there are flowerbeds consisting of perennial plants: *Astilbe arendsii*, *Gloria Purpurea*, *Hósta*, *Potentilla fruticosa* Abbotswood, *Saxifraga arendsii*, *Heuchera*. On the territory of the Kupechesky Dvorik near the buildings there are signs with the name of the object, QR and bar codes. The created landscaping elements attract with their beauty, aesthetics and environmental friendliness which contributes to the creation of a high-quality urban environment and an increase in the tourist attractiveness of the village of Ustye.

Keywords: *Rural areas improvement, landscape design, landscaping types, flowerbeds, lawns.*

THE INFLUENCE OF DIFFERENTIATED TECHNOLOGIES ON THE INDICATORS OF THE STRUCTURE OF THE VICO-WHEAT MIXTURE IN THE CONDITIONS OF THE URALS

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Abstract

In 2021, research was conducted on the basis of the Perm Research Institute of Agricultural Research of the PFIC UrO RAS (Perm Krai, Perm district, Lobanovo village). The soil of the experimental site is sod-podzolic heavy loamy. The object of research is sowing vetch, variety "Mega" and spring wheat, variety "Kamenka", the selected varieties are zoned for the Perm Region. The technology of cultivation of crops is generally accepted for the area of the Urals. The paper shows the effectiveness of the application of differentiated technology of fertilization on vico-wheat mixture. Data for the introduction of herbicides were presented in the form of task maps in offline mode. Before sowing, agrochemical studies of soils were carried out at the experimental site to determine the actual required doses of fertilizers. Fertilizers were applied in a differentiated way based on the results of remote sensing data, which significantly reduced the amount of fertilizers used. During the harvesting period of the studied crops, the yield structure was selected. Under laboratory conditions, the mass of 1000 seeds, the productivity of stems, biological yield, etc. were calculated. The best ratio of vico-wheat mixture was determined, the payback of differentiated fertilization was calculated and the option with the maximum increase in yield was identified.

Keywords: *differentiated fertilization, sowing vetch, wheat, Earth remote sensing data.*

LEVELS OF FARMERS' DEALINGS WITH SOURCES OF STATISTICAL DATA AND INFORMATION, AND THEIR PERCEPTIONS OF ITS IMPORTANCE IN ON-FARM DECISION-MAKING PROCESS IN THE KINGDOM OF SAUDI ARABIA

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Abstract

In light of the Kingdom of Saudi Arabia vision 2030, the Ministry of Environment, Water, and Agriculture (MEWA) realized the importance of updated agricultural statistical data and information to help farmers to manage their farms efficiently and effectively, this research aims to identify the level of dealings of Saudi's farmers with different sources of statistical data and information and the extent of its importance for farm decision-making from the respondents' point of view. Data were collected from 576 farmers around the kingdom, during May 2020 using an electronic questionnaire. Frequencies, percentages, mean, and range were used in data analysis and presentation. Results showed that 58.3% of respondents hold a bachelor or postgraduate studies. Most of them (86%) had 6 years or more of agricultural experience. It also turned out that farmers' production pattern was largely concentrated on dates, vegetables, livestock and fodder, respectively. Findings, also, showed that 79.5% of respondents did not take advantage of sources of statistical information and data to make farm decisions. Results also, showed that 35.2% of respondents were in low category of knowledge, 41% were in medium level, while only less than one quarter (23.8%) of them had high level of knowledge. Findings showed that most utilized sources were: neighbors (average= 2.18), personal relations (2.16), and the Internet (1.98); while the lowest sources were Arab and international organizations and bodies (0.80), the Saudi General Statistics Authority (0.82) and the headquarters of the MEWA (1.09). Results also, indicated the contribution of statistical data and information in raising farmer' ability to make decisions and design appropriate policies for farm production (average=2.73), helping to predict the direction of agricultural markets and reducing risks (average=2.72), increasing the ability to monitor and evaluate farm performance and measure success in achieving goals (average=2.70), and reducing the percentage of work risks (average=2.70).

Key words: *Statistical Information, Data, farms, Saudi Arabia.*

ANALYSIS OF SORGHUM AND MILLET VALUE CHAINS IN SENEGAL TO IMPROVE THE NUTRITION STATUS OF THE POPULATIONS

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Abstract

Although millet and sorghum are among the most important staples produced in Senegal, the value chains are not well organized and there is a weak link between the different stakeholders. For instance, it is not uncommon to see food processors in Dakar, Senegal, travelling to the surrounding countries, looking for supplies of cereals, when at the same time farmers living in Tambacounda, Senegal, with thousands of unsold metric tons of cereals. The objective of this study on millet and sorghum in Senegal was to propose a structured model of the value chains in order to develop high-quality cereals leading to high value nutritious processed products based on the cited cereals. Surveys were conducted among 60 randomly selected producers of millet and sorghum in three regions and 40 processors in seven cities, and among other important stakeholders. Results have shown the importance of millet and sorghum in the cultural system, despite the weaknesses of yields (635 kg/ha and 366 kg/ha for millet and sorghum, respectively). Also, findings suggest that the links between stakeholders could be strengthened, specifically between processors and farmers. A good value chain model for both staples, strongly linking all stakeholders, has a strong potential: processors will spend less money, no longer going abroad to get supplies of cereals; farmers will make more money by getting access to a sustainable market (country processors) and high-quality seeds will be at their disposal. Highly nutritious processed foods will get into the market to positively impact the nutrition status of populations.

Keywords: *value chain; millet; sorghum; processing; nutrition*

CALCULATION PRICE OF TRACTOR OPERATION BASED ON COSTS

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Abstract

Depending on the annual engagement of the tractor, on average from 400 to 500 hours, the calculation of fixed and variable costs for the MTZ 952 tractor is presented in the paper. Fixed costs refer to the costs of interest, depreciation, insurance, garaging and registration. Variable costs include fuel, lubrication, repair, and maintenance costs. In addition to the mentioned costs, profit margin and gross salary of workers were added, which influenced in formation of price of tractor work services and is shown in the calculation. Based on the total annual costs from 19,140 to 22,855 EUR hourly labor price from 45.71 to 47.85 EUR was calculated according to annual tractor engagement of 500 to 400 hours. With a higher annual engagement of tractor 500 hours, stated costs per hour were lower. In the structure of formation price of tractor work, variable costs are represented by 62.27-64.56%, fixed costs 13.14-15.68%, the salary of worker 6.46-6.76%, and profit margin had a share from 15.59-15.64%. Based on the calculated costs, farmers can realistically form service prices for tractor work. Also, the obtained results help them in rational decision-making to choose what is more profitable for them to purchase a new tractor or to hire a tractor from other farmers.

Keywords: *tractor, labor cost, fixed, variable, cost*

PROFITABILITY FACTORS OF MICRO AGRICULTURAL COMPANIES FROM THE REPUBLIC OF SERBIA: PANEL ANALYSIS

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Abstract

Profitability is a basic indicator of business success of a company, ie. profitability is the ability of a company to generate profit. In addition to the analysis of profitability indicators, it is necessary to investigate the factors that affect profitability. Adequate profitability analysis needs to be conducted not only at the company level, but also at the sector level. In this regard, agricultural production as the carrier of the primary sector is of strategic importance for the development of the entire economic system of the Republic of Serbia. According to the importance of this industry, the subject of this research will be micro agricultural companies that operated in the territory of the Republic of Serbia in the period 2010-2019. The aim of the research is to assess profitability, as well as microeconomic and macroeconomic factors that affect profitability. From microeconomic factors, liquidity, financial leverage, indebtedness, various ratio indicators of asset management efficiency, capitalization rate and sales rate were analyzed, and from macroeconomic factors, the GDP and inflation were analyzed. The data were first processed by descriptive statistical analysis, and then the panel regression analysis method was used to determine the factors influencing profitability. The results of the panel regression analysis showed that indebtedness, capitalization rate, total asset turnover ratio, fixed assets turnover ratio, current assets turnover ratio and GDP had a statistically significant impact on the profitability of the observed companies. However, of the selected significant factors, the total asset turnover ratio, current assets turnover ratio and GDP have a significant and positive impact on profitability, while indebtedness, capitalization rate and fixed asset turnover ratio have a significant and negative impact on profitability observed companies.

Key words: *profitability, agricultural companies, Republic of Serbia, performance.*

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THE LAND CONSOLIDATION AND STRATEGIES FOR AGRICULTURAL LAND PROTECTION

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Abstract

In this research the authors investigate the capacity of land consolidation for agricultural land protection. The significance of agricultural land is expecting to rise in the future because of its scarcity and decrease of its potential of food production. Those facts from the aspect of increasing human population and the agricultural land as a main source of food imply that every measure for land protection is justified. Land consolidation as a proven model for agricultural land management can also include the agricultural protection in the phase of its design. The authors state that, if aspect of agricultural land protection in the phase of land consolidation design is neglected, it is difficult to remedy the negative consequences on agricultural land in long period. In the paper some theoretical and practical aspects of agricultural land protection are discussed including agricultural land deterioration caused by erosion and/or desertification and possibility to prevent or mitigate their negative effects by land consolidation. The economic analysis also implies that land consolidation activities are the best chance for implementing strategies for agricultural land protection by including the land protection goals into the set of land consolidation goals.

Keywords: *Sustainability, Food production, Efficient land use, Land consolidation goals*

STRUCTURAL AND NON-STRUCTURAL CARBOHYDRATES CONTENT OF APPLE POMACE SILAGES

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Abstract

Apple pomace was ensiled without additives and with the addition of 15% dried beet pulp in order to increase the level of DM, 15% of sunflower meal and 15% dry beet pulp and 1% of NPN substances, and each of these treatments with and without inoculant. Apple pomace (AP) was obtained from the factory VINO Župa Aleksandrovac, delivered to the Institute of Forage Crops in Kruševac, location Globoder, on April 2nd 2013 and ensiling was performed on April 3rd 2013. Study treatments in the present research of the apple pomace silage were: added feed (A) and applied inoculant (B): A₁ - ensiled apple pomace 100% participation (a₁b₁ - apple pomace without inoculants; a₁b₂ - apple pomace with inoculants; A₂ - apple pomace 85% + 15% of dry beet pulp (a₂b₁ - without inoculants; a₂b₂ with inoculants); A₃ - apple pomace 85% + 15% sunflower meal (a₃b₁ - without inoculants and a₃b₂ with inoculants); A₄ - apple pomace 84% + 15% sugar beet pulp + Benural S 1% (a₄b₁ - without inoculants and a₄b₂ with inoculants). Results of these investigations showed that apple pomace silage with dry beet pulp had the highest CHO (817.8 g kg⁻¹ DM), NFC (358.7 g kg⁻¹ DM) and WSC (44.9 g kg⁻¹ DM) contents. This study has shown that apple pomace silages, as a by-product of the technological process has significant nutritional value.

Keywords: *apple pomace silage, dry beet pulp, sunflower meal.*

PREDICTION OF SUNFLOWER PRODUCTION IN THE REPUBLIC OF SERBIA

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Abstract

The paper, using a quantitative research method, aimed to create an adequate model for predicting the production parameters of sunflower in the Republic of Serbia in the next three years. The selected trend model was used for that, and the analyzed seventeen-year series of data ranged from 2005 to 2021. The results of research obtained using three measures of accuracy of trend selection (*Mean Absolute Percentage Error, Mean Absolute Deviation, Mean Squared Deviation*) show that all three observed parameters of sunflower have a positive tendency to grow with greater oscillations in production. The results of the research can serve the purpose of making rational strategic decisions in the future when it comes to the production of this oilseed.

Keywords: *Sunflower, Prediction, Trend, Republic of Serbia*

TENDENCIES AND PREDICTION OF MAIN ANIMAL PRODUCT PRICES AND PRICE PARITY IN SERBIA

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Abstract

In this paper, subjects of research were prices and price parities of important kinds of animal products in Serbia – fattening pigs, cow's milk and fattening chicken. The main goals, based of quantitative analysis, were to find out tendencies in prices and prices parities movements, and to predict it in future period. The absolute prices are analyzed in the period 2002-19. The analysis of the relative prices, which are prices parity of certain animal product in relation to maize, was conducted for the period 1994-2019. The aim of this analysis was to formulate the relative changes of the economic position of certain animal product in relation to maize. Prediction of the prices was made for a five-year period, 2020-2024. ARIMA models were used for predict of price parity. Change rates were used to forecast absolute prices. Quantitative analysis was performed by using descriptive statistics method, and prediction period was 2020-24. Average year price of pigs was 1.65euro/kg. Price was changing in interval between 1.05 and 2.40euro/kg. Annual change rate of pig price in Serbia was minus 0.21%. Average year price of milk was 0.24euro/l. Price was changing in interval between 0.17 and 0.29 euro/l. Annual change rate of milk price in Serbia was 2.57%. Average year price of chicken was 1.04 euro/kg. Price was changing in interval between 0.72 and 1.87 euro/kg. Annual change rate of chicken price was minus 1.63 %. The average price parities of animal products for the period 1994-2017 will have next forecast for year 2024: pig's price parity will decrease from 14.25 to 13.29; milk price will change insignificantly, from 1.85 to 1.86; chicken price will decrease from 11.85 to 4.40. Absolute prices of animal products predict in 2024 on the next level: pigs 1.58euro/kg, milk 0.31euro/l and chicken 0.75 euro/kg.

Key words: *animal products, prices, prediction, Serbia.*

WORLD AGRICULTURAL SYSTEM AND FOOD SAFETY, CHALLENGES AND PERSPECTIVES

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Abstract

World food demand is growing steadily, driven by the combined effects of population growth and per capita income. Supply is currently still able to meet demand. However, dilemmas justifiably arise as to whether there is still room for further growth in agricultural production and yield growth, given the unpredictable changes in the main factors of production. It is necessary to comprehensively consider the different dimensions of food safety and identify key factors that affect it, especially through the role of productivity, technological discoveries, different agricultural models, regional development, policies and other factors that go beyond the basics of the market. Different income levels and projections of income growth, as well as cultural preferences related to nutrition, will be the basis for constant differences in consumption patterns between the region and individual countries of the world. The growth in demand for agricultural products has been accompanied by increased efficiency in crop and livestock production, but also by strong constraints such as global pandemic challenges and wars of varying magnitude. This will certainly affect the instability of real agricultural prices and keep them at a high level. Climate variability, changes in input prices, macroeconomic developments and other uncertainties will lead to pronounced variations in world agricultural production over a long period of time.

Keywords: *food, security, market, prices, trends*

TRENDS OF CHANGES IN FOOD PRICES ON THE WORLD MARKET

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Abstract

The market of agri-food products is viewed by analyzing the supply and demand factors and their implications on the level and dynamics of prices. From an economic perspective, these components determine the dynamics of market equilibrium in a shorter and longer period of time. Price variability is essentially a very important segment of market functioning, where it is adjusted to changing market conditions. The level and volatility of world food prices increased significantly in the previous decade, and a strong escalation occurred in early 2022. The increase in food prices during 2021 and 2022 caused great upheavals on the world market. According to the FAO index, international prices for major food items have risen to a level close to the peak of the global food price crisis of 2007-2008. In many countries, consumer prices have risen, creating a sense that this could lead to increased food insecurity. High prices jeopardize security and access to food, while their instability jeopardizes the predictability of farmers' incomes. In both developed and developing countries, consumers are facing the impact of higher food prices, and producers are feeling the pressure of higher entry costs. Several factors are responsible for the movement of agricultural prices. Among the various causes identified, there are changes in demand growth, both for human consumption and for industrial use, slowdown in yield growth and access to land, joint movements in agricultural prices with energy and other commodity prices, contractions in agricultural markets, changes in inventories, unfavorable or beneficial weather events and the effects of restrictions on trade in agricultural products.

Keywords: *prices, agricultural production, food supply, trends*

FORECASTING TOMATO PRICES ON MARKETS IN THE REPUBLIC OF SERBIA USING THE ARIMA MODEL

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Abstract

Vegetable production is a highly intensive and profitable branch of agriculture, which can have a significant effect on the development of the agricultural sector. In the Republic of Serbia, tomatoes are grown in open fields and in different forms of protected areas (plastic and glass greenhouses). Tomatoes are grown worldwide on over 5,000,000 ha, and in the Republic of Serbia, according to the data retrieved from the National Statistical Office (RZS), tomatoes are grown on about 8.000 ha, being the most commonly grown vegetable crop (together with potatoes and peppers), with an average yield of almost 15 t/ha and total production of 111,639 metric tons (FAOSTAT). Tomato prices differ over quarters in a year, and those discrepancies are not small. Tomato prices are therefore twice/twice and a half times lower in summer than in winter, primarily due to the way of production, based on which it can be concluded that the production season significantly affects the price of this agricultural commodity. Apart from the way and technology of production, the price is greatly affected by the market, and in this case by the import from the neighboring countries. The goal of this paper is the tomato prices' forecast by quarters of 2021, based on the prices from the markets in the Republic of Serbia in the period 2014-2020, recorded and kept within the Market Information System of Serbian Agriculture (STIPS), and by using the ARIMA modelling. Moreover, this analyzes can be used to project the prices for other agricultural commodities and such analyzes can help greatly in current global crisis caused not only by the COVID-19 pandemic, but also by the current war situation in Ukraine.

Keywords: *ARIMA, price, tomato, market, Serbia.*

VEGETABLE GARDENS EFFECTS ON HOUSHOLDS' SUSTAINABILITY IN THE GERT SIBANDE DISTRICT, SOUTH AFRICA: A MESMIS MODEL APPROACH

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Abstract

The Gert Sibande district (Mpumalanga Province) is impaired with a high poverty rate of 46.5%. As a result, the Agricultural Research Council in partnership with the Department of Agriculture, Land Reform and Rural Development signed a Service Level Agreement to improve communities in nine provinces of South Africa through the development of a vegetable garden strategy- The Agricultural Paraprofessional Development Programme (APPDP). The objective of the APPDP was to create and support sustainable rural development through improved food production, food security and household incomes. Even so, beneficiaries of the project recorded the following challenges: lack of infrastructure, loss of interest in gardening and water scarcity. The study aimed to analyze the effect of vegetable gardens on households' sustainability in Gert Sibande. Semi-structured questionnaires were administered to 54 purposively selected vegetable gardening households. The descriptive statistics, Management Systems Assessment Framework Incorporating Sustainability Indicators Model (MESMIS) and Pearson correlation coefficient were applied to meet the study's objectives. Data were analyzed using the Statistical Package of Social Sciences Version 25. The study revealed that 63% of the households generated income through vegetable gardening. Output sold was negatively correlated with number of household members, at 0.270 correlation coefficient. The higher the household members, the less output sold and the less food available to support social initiatives. In addition, households were not aware of environmental issues such as water recycling, maintenance of local biodiversity and soil management. Overall, the study concluded that the vegetable initiative has great potential to enhance the livelihoods of rural communities.

Keywords: *Vegetable gardens, Households, Sustainability, Gert Sibande District, Mpumalanga Province.*

SOCIO-ECONOMIC AND FOOD SECURITY STATUS: A CASE STUDY OF THE SELECTED HOUSEHOLDS IN THE GERT SIBANDE DISTRICT, SOUTH AFRICA

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Abstract

A report by the Food and Agriculture Organization (FAO) emphasizes that the world is not on track to eradicate hunger as envisioned in the 2030 Sustainable Development Goals (SDG's). The share of the population below the poverty line in Gert Sibande District has also worsened (46.5%), making it the second highest of three districts in the Mpumalanga Province. This study evaluates the socio-economic and food security status of the selected households in Gert Sibande District. The study used a purposive sampling procedure to select 54 sample households, which were interviewed using semi-structured questionnaires. The descriptive statistics were used to evaluate the socio-economic and food security status of households using qualitative and quantitative methods. The data were analyzed using the Statistical Package of Social Sciences Version 25. The results found that 13% and 87% of the households were food secure and food insecure, respectively. Moreover, of the households who were food insecure (FI); 34% were mildly FI, 51% moderately FI and 15% severely FI. Most of the food insecure households were younger females less than 35 years of age with a household composition ranging from 1 to 5. It was also established that dark green leafy vegetables and 'other' vegetables were the most accessible and consumed food groups. The study concluded that household participation in the vegetable project can potentially improve their farming knowledge, increase production and income, and ultimately flatten the food insecurity status. The paper proposed that government agencies should continue investing in agricultural infrastructure, farm knowledge and education.

Keywords: *Socio-economic status, Food security status, Households, Gert Sibande District, Mpumalanga Province.*

FACTORS AFFECTING THE PRODUCTION STATUS OF SMALLHOLDER CROP FARMERS IN THE UNION OF COMOROS, SUB-SAHARAN AFRICA

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Abstract

Smallholder farms constitute 80% of all farms in Sub-Saharan Africa. The main activities which households pursue to sustain their livelihoods in the Union of Comoros are agriculture and fishing. Staple crops contribute almost 80% of the country's agricultural production value. Recent data however shows that poverty in the country is growing with more than 54% of the population living below the poverty line. The rate is higher among farm families. To address such challenges, the government of the Comoros through the South African government requested expert assistance from the Agricultural Research Council (ARC), a South African government organization for supporting and enhancing agricultural practices with adaptive research. The study aimed to determine the factors affecting the production status of smallholder crop farmers in the Union of Comoros. A total of 155 smallholder farmers were selected through a stratified sampling procedure. A closed-ended questionnaire was administered to farmers. The primary data was analyzed quantitatively using the Statistical Package for Social Sciences Version 26. The Descriptive Statistics and Ordinal Logistic Regression model were adopted to meet the objectives of the study. The paper revealed the production status of smallholder farmers as follows: 26% very poor; 8% poor; 55% average; 12% good. It was concluded that the most important factors affecting farmers' production status were age, land size and the condition of water resources. The probability of an active production status was reduced by 0.00057 if the farmer increased the farm size by an additional hectare. Contrary, middle-aged smallholder farmers who had water resources in good condition were more likely to improve their production status. For an active production status, the study suggests that middle aged farmers whose primary occupation is farming should be the main targets of agricultural projects/incentives in the country.

Keywords: *Factors, Production status, Smallholder crop farmers, Union of Comoros, Sub-Saharan Africa*

DELIVERANCE OF RURAL MARKETS THROUGH CLIMATE-SMART TECHNOLOGIES: CASE STUDY OF GLADSTONE VILLAGE, FREE STATE PROVINCE, SOUTH AFRICA

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Abstract

The study was motivated by the lack of access to markets by rural farmers due to various challenges, leading to poverty and malnutrition, as this cannot be overcome by focusing only on the lack of implements, poor access to finance, shortage of rainfall, unworkable and dysfunctional institutional arrangements. The primary data was collected from 40 households that adopted climate-smart technologies through a detailed questionnaire. Discussions were held with the elders (farmers) and youth. The respondents were selected using stratified sampling. The first questionnaire focused on institutional arrangements as to how they contributed positively or suppressed agricultural production within the village. A second questionnaire was used to gather information on the households involved in agricultural activities. Most of the mentioned institutional arrangements were formal, but not applied and adhered to by everyone and were difficult to enforce due to political interference. Nevertheless, farmers and villagers were positive and suggested some new ones that they believe could play a vital role in the long run for their benefit. Therefore, once appropriate and workable institutional arrangements were adopted and traditional leaders recognized as the constitution states, villagers and/or farmers were to work closely with them. The social, economic and psychological conditions of farmers improved from farmer to farmer (household to household) and that has led to improved productivity and reduced the state of dependency. Functional, appropriate and workable institutional arrangements were adopted and traditional leaders were recognized since they were protected by the constitution.

Keywords: *rural farmers, climate-smart technologies, institutional arrangements, traditional leaders, economics.*

THE EFFECT OF DEMOGRAPHIC FACTORS AND CONSUMER BEHAVIOURS ON RED MEAT CONSUMPTION EXPENDITURES

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Abstract

Red meat; in addition to its importance in adequate and balanced nutrition, it has a special importance for Turkey in terms of being the main source of livelihood in rural areas and production tradition for generations. It is known that there is always a relationship between the welfare level of countries and their consumption habits. According to the data of the Association of Red Meat Producers in Turkey, meat consumption is below those of the Organization for Economic Development and Cooperation (OECD) countries. While the annual per capita consumption of red meat was 12 kilos on average in 2019, it decreased to 7-8 kilos in 2020. In this respect, policies to be implemented to increase red meat consumption, are of great importance. In this study, the effects of demographic characteristics and consumer behaviour on red meat consumption expenditures were examined. The data of the study were obtained from face-to-face interviews conducted with 400 households in Erzurum, Erzincan and Bayburt provinces which in Eastern of Turkey. In the first part of the study, the demographic characteristics of the interviewed consumers and their purchasing behaviours in red meat consumption were discussed. In the second part, the results of the analysis revealing the effect of demographic characteristics and consumer behaviour on red meat consumption expenditures are included. Solutions have been proposed with a holistic approach, taking into account the red meat supply chain, to the problems that arise regarding red meat consumption.

Key words: *consumption, consumer behaviour, demographic factors, red meat.*

MARKETING CHANNEL PREFERENCES OF DAIRY PRODUCERS AND THEIR PRICES: THE CASE OF GÜMÜŞHANE PROVINCE

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Abstract

Dairy farming in Turkey is the main source of livelihood and an important source of income for most of the rural farmers. The dairy sector also provides economic benefits to all intermediary channels from production to consumption. Ensuring the sustainability of dairy farming requires a good analysis and development of the marketing channels used by the producers. Dairy producers may encounter different prices in the marketing channels they prefer in marketing their products. This can directly affect milk supply and consumption. In this study, milk marketing channels of traditional dairy cattle producers and their prices according to these channels were examined. The data of the study were obtained from face-to-face surveys conducted with 102 producers in Gümüşhane. In the first part of the study, the socio-economic characteristics of the interviewed producers were discussed. In the second part, the marketing channels through which the producers sell their milk and the prices they obtain according to these channels are presented. In the third part of the study, the level of economic benefit provided to the marketing channel preferences of the producers is discussed.

Key words: *Milk production, Marketing channels, preferences, Milk prices, Turkey.*

EXPLANATION OF THE REASONS FOR PRICE CHANGES IN THE SUPPLY CHAIN OF SELECTED AGRICULTURAL PRODUCTS

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Abstract

Marketing processes of agricultural products have a special importance due to their organic structure. Agricultural products are generally marketed through intermediaries due to the small scale of Turkish agricultural enterprises and the lack of organized structures in the sector. Since the actors in the supply chain include producers, brokers, traders, wholesalers, marketers, retailers and consumers, there is an increase in product prices in the process of delivering the product from the producer to the consumer. This increase in the supply chain is called the “market margin”. The high market margin of agricultural products causes the perception that product prices are increased by the actors in the marketing channels and that unfair profits are obtained. Since changes in agricultural product prices have a significant share in consumer expenditures, prices are followed with interest by consumers and consumer behavior changes according to market conditions. In addition, due to its share in inflation, economic management and all segments of economic activity closely monitor the changes in the prices of agricultural products. Changes in the prices of agricultural products are closely followed throughout the country, and they are exposed to speculative approaches, discourses and accusations, especially by the media. This situation causes loss of motivation for those operating in the sector from production to consumption. For this reason, it is aimed to explain the reasons for price increases by examining the supply chains of selected agricultural products. For this purpose, producer and consumer prices of basic agricultural products were determined and market margins were calculated. The result of the study is thought to help producers, organizations and policy makers in the formation of policies related to the marketing of agricultural products and the development of marketing strategies.

Keywords: *Food, Market Margin, Marketing, Market, Agriculture.*

THE EFFECT OF AGRICULTURAL INPUT PRICES ON FARMERS' PURCHASE POWER

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Abstract

The sustainability of agricultural production depends on the costs of the farmers in the production processes and the income they earn after production. The increase in the price of the inputs used in agricultural production causes a decrease in profit margins and adversely affects production. In general, the course of price changes in the markets is followed by price index values. Price indices are important for understanding the purchasing power of farmers and monitoring the current conditions in the sector. In this study, the main purpose is to examine the changes in the purchasing power of farmers according to products and years and to determine the effect of price changes on agricultural production. For this purpose, secondary data were used in the study; in the selection of the data, 45 products, which have a significant weight in the inflation basket, were selected. Producer prices and input price indices of selected products were compiled from TURKSTAT. The changes in the purchasing power of the farmers according to the products and years were calculated. Changes in the purchasing power of farmers contain important clues in terms of determining social welfare in rural areas and sustainability of agricultural production. By evaluating the results obtained in these aspects, discussions were made on the current situation, and policy recommendations were developed for agricultural input markets and the purchasing power of farmers.

Keywords: *Farmer, Price, Welfare, Purchasing Power, Agriculture.*

COMPARISON OF FOOD SAFETY BY COUNTRY

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Abstract

As a result of the increase in food demand due to population growth and the fact that food safety is among the priority issues for many countries and international organizations, the number of scientific studies carried out to measure and understand food safety has increased. The heterogeneity of available data makes cross-country comparison difficult; encouraged international organizations to create unified and comprehensive indexes. Indices using different variables have been developed by institutions such as FAO, IFPRI, EIU, WFP, UN in order to reveal the status and developments of food security in a particular country or region, to estimate the reasons, severity and duration of food safety, and to offer solutions by determining the necessary measures. The most widely used among these indices are the Global Food Security Index (GFSI) and FAO food safety indices, and it is aimed to compare the food safety indices by country within the scope of this study. In addition, since the indices used in the study are calculated with the combination and weighting of different indicators, there are inadequacies in terms of revealing the severity of food safety and its main causes, determining risk factors and policy preferences. In this study, besides the FAO and GFSI indices, production and marketing losses, which are accepted as important indicators of food safety, were compared according to the countries in terms of product groups. Thus, the main reasons preventing food safety were analyzed in the sense of accessibility, availability, quality and safety dimensions. Policies were reviewed according to the determined product groups and suggestions were made for the realization of new investments in the sector.

Keyword: *Food Safety, Marketing Losses, Welfare, Agriculture, Production Losses.*

GREEN CONSUMPTION IN VIETNAM A CASE STUDY OF YOUNG PEOPLE IN HANOI

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Abstract

Green consumption comes from the desire to protect natural resources for future generations and improve people's quality of life. Vietnam is facing challenges in environmental protection and sustainable development. Population growth leads to higher consumption demands of society. Therefore, the implementation and application of green consumption policies in Vietnam is necessary to encourage sustainable production and consumption. The study aims to assess the current situation and factors affecting green consumption in Vietnam, especially focusing on young people because they make up more than half of the national population. Primary data were collected through interviews with 120 people between the ages of 15 and 35 in Hanoi capital. The results show that 75% of young consumers save water; 77.5% of young consumers save electricity. The reason that motivates them to practice saving water and electricity resources is related to family finances. Moreover, 73.3% of people tend to consume green products and 76.6% of respondents forecast that the trend of consuming green products will increase in the coming time. However, only 54.1% of young consumers have knowledge about green products and 56.6% of the interviewees know where to buy green products. The study also shows that high price is a factor that hinders consumers from looking for green products. Besides, many other factors affect young people's green consumption behavior such as: educational level, residence status, income, knowledge, etc. Young people have high qualifications, people with higher income, and people with environmental concerns tend to consume more green products than the rest.

Keywords: *Green consumption, Young people, Hanoi, Vietnam.*

FORESTRY AND AGRO-FORESTRY

CHARACTERIZATION AND GERMINATION OF ATLAS PISTACHIO SEEDS IN ALGERIA

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Abstract

The Atlas pistachio tree (*Pistacia atlantica* Desf. subsp. *atlantica*), is a hardy and spontaneous tree growing in different bioclimatic zones in Algeria. Unfortunately, this species is in rapid decline because of the dormancy of its seeds which is an obstacle limiting its germination and the obtaining of seedlings. Our results showed that germination of whole seeds of three different regions is not efficient and that scarification by removing the epicarp did not significantly improve the germination rate. The phenolic acid contents, which consist mainly of gallic and chlorogenic acids, are variable according to the ecotypes. Biochemical analysis of different parts of the fruit indicated that the seeds, kernel and epicarp were very rich in total phenolic compounds, which induces biochemical dormancy with integumentary dormancy in these seeds, and consequently inhibition of germination. Our results suggest that seed dormancy is chemical in nature and concerned, not only with the epicarp, but also the kernel. The application of hydrogen peroxide induced a significant increase in the germination rate of the seeds. The hydrogen peroxide, which is one of the ROS, would inhibit the effects of phenolic compounds, accelerate the dormancy emergence and consequently improve the germination rate of Atlas pistachio seeds.

Key words: *Atlas pistachio*, *seeds*, *germination*, *dormancy*.

STUDY OF THE GROWTH AND PRODUCTIVITY OF ALEPPO PINE PLANTATIONS IN THE GREEN DAM (ALGERIA)

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Abstract

To fight against desertification and the degradation of the steppe environment and to maintain the socio-economic balance, Algeria embarked on an ambitious project at the beginning of the 1970s. This project called "the green dam" was carried out by the planting of hundreds of thousands of hectares of Aleppo pine in the first phases of its realization. The choice of this species has aroused much criticism, especially since the failure in certain regions was fatal. Our study aims to carry out an ecological assessment of the plantations carried out within the framework of this project by a dendrometric (total height, DBH, basal area, density) and dendroecological (evolution of radial growth) approach at the level of 06 Aleppo pine populations. The results obtained show that the growth of Aleppo pine varies from one station to another depending on the altitude, the slope. Sloping land and / or in southern west exposure offer the best growing conditions. On the other hand, in flat terrain growth is very weak. These results obtained made it possible to identify a certain number of elements of answers as for the current state of the stands and their adaptation with the conditions of the environment. These results can be used by managers for future reforestation projects.

Keywords: *Algeria, plantation, Aleppo pine, Growth, productivity.*

CHARACTERIZATION OF FOREST SOILS IN DJEBEL EL OUAHCH NATIONAL PARK, CONSTANTINE, ALGERIA

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Abstract

The forest plays a vital role in the biological, ecological and economic balance in our country. It is the result of millenary interactions between the climate, the diversity of geological and edaphic contexts. The objective of this study was to determine and evaluate the physicochemical parameters of forest soils in two zones of the Djebel El Ouahch (Constantine) national park, which were exposed to two bioclimatic stages (sub-humid and semi-arid). The samples were taken at a depth between 0 and 20 cm in each zone on sampling stations of 400 m². Our results showed that the bioclimatic stage affected the physico-chemical properties of the soils by increasing the percentage of humidity, the rate of carbon, nitrogen and organic matter in the sub-humid zone. On the other hand soils in the semi-arid zone are vulnerable and fragile due to their texture, a low water retention capacity, the rate of degradation of organic matter and a high rate of total limestone. The intense drying and the vulnerability of the soils in the semi-arid zone could reduce the long-term physico-chemical fertility with the consequence of a regression of the vegetation and the alteration of the biodiversity.

Keywords: *Forest, bioclimatic stages, soil properties, degradation, Djebel El Ouahch.*

PUPA MORTALITY OF *THAUMETOPOEA PITYOCAMPA* DENIS & SCHIFFERMÜLLER, 1775 (LEPIDOPTERA: NOTODONTIDAE) IN ALGERIA

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Abstract

The pine processionary moth *Thaumetopoea pityocampa* (Denis & Schiffermüller, 1775) (Lepidoptera: Notodontidae) is one of the most serious pests of pine and cedar forests in Southern Europe and North Africa. In northern Algeria outbreaks occur in Aleppo pine (*Pinus halepensis* Miller) forest particularly in the semi-arid area and in Atlas cedar forest (*Cedrus atlantica* Manetti) in sub-humid elevation area. This work, carried out in northeastern and northwestern Algeria, aimed at studying pupal mortality of this pest on two host species, *C. atlantica* and *P. halepensis*. Three types of antagonist factors were assessed: (i) natural mortality (dried pupae), (ii) mortality caused by parasitoids and (iii) diseases. For this goal, 1382 mature larvae at the end of their activity were collected and examined. The overall mortality rate of pupating larvae of *T. pityocampa* due to several factors ranged from 13.7% to 31.1%. Mortality of *T. pityocampa* caused by parasitoids ranged from 7.0% to 11.9%. The mortality due to mycoses was limited between 2.7% to 6.3%. Three parasitoids species belonging to the Diptera have been identified: *Exorista segregata* (Rondani, 1859), *Phryxe caudata* (Rondani, 1859) (Tachinidae) and *Hemipenthes* sp. (Bombyliidae). The primary parasitoid *E. segregata* was the most abundant comprising almost 65% of the total emerging parasitoids. To this, we note the presence of the entomopathogenic fungus, *Beauveria bassiana* (Deuteromycotina: Zygomycetes) which, despite its low presence, can be used in an alternative biological control.

Key words: *Thaumetopoea pityocampa*, coniferous forests, pupal mortality, parasitoid

LOCAL VALUATION AND ECOLOGICAL EFFECTS ON THE HABITAT OF BAOBAB (*Adansonia digitata* L.) IN BENIN

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Abstract

Adansonia digitata L. is a multipurpose species in Africa and is used therapeutically, food, economically and socioculturally. This study aims to determine the different uses and their implication in the destruction of natural habitats of Baobab in Benin. The data were on the uses of fruits, peels and seeds carried out in the Guinean zone located between 6 ° 25 "N and 7 ° 30" N and in the Sudanese zone located between 9 ° 45 "N and 12 ° 25" N. The results show that the fruits are rich in calcium (12.5-15%) and the populations consume the fruits directly or transformed into juice. The seeds are used in the preparation of broths and the bark is used in the production of strings. Crop losses ranging from 10-25%, 15-36% and 8-45% respectively for fruits, seeds and bark according to the climatic zones of the study. Ecologically, the species is found in dry forests, savannas and on agricultural land with a high capacity for resistance and adaptation to climatic variability. However, human threats reduce the range of the species and cause habitat loss. The uses of the different parts of the species must be regulated and rational.

Keywords: *Habitat loss, Multiple uses, NWFP, Sustainable management.*

LOCATIONS OF BALKAN MAPLE (*Acer heldreichii*. ORPH) IN THE EASTERN PART OF BOSNIA AND HERZEGOVINA

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Abstract

This scientific research paper presents the results of the study of Balkan maple sites in the wider part of the Trebevic, Jahorina and Tivicijak mountains in the vicinity of Rogatica. Balkan maple as a species stretches along the entire Balkan Peninsula from Greece in the south, Bulgaria, Northern Macedonia, Albania, Montenegro, Bosnia and Herzegovina, all the way to the northernmost site in Serbia on Mount Rudnik, the northernmost site in Bosnia and Herzegovina on the slopes of Mount Trebevic. Based on detailed field research and data processing at the three sites above, we concluded that *Acer heldreichii* as a mountain species in the forests of Bosnia and Herzegovina, and according to the measured 10-year increment, tolerates low temperatures and very short growing seasons well.

Key words: *Balkan maple, Acer heldreichii, Trebevic, Jahorina, Rogatica, Bosnia and Herzegovina, growth, height, diameter*

LAND USE FOR SUSTAINABLE DEVELOPMENT (SD): EFFECTIVE LAND USE PLANNING (ELUP) IN SOUTH WESTERN CAMEROON (SWC)

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Abstract

Land is part of the earth, interacting with the atmosphere. Land use change and vegetation modification characterize and qualify Lands. Cleared vegetation create need for land use planning. ELUP for SD2030, is therefore our objective. Impacts in SWC, are to be used in plans and strategies, against further destruction. Ecosystems of SWC are humid, monomodal and tropical. Related land-use change, their extent and patterns in Landscapes identified in to land units, FAO land use planning run down to municipalities. Based on LUT and LUR, sustainable ELUP, developed guidelines, gradually precises Land use systems, in holistic environmental and ecological units. SD based lands for actual Land use or improved potential Land use, show the best sustainable land use on young volcanic and sedimentary soils. Integrated farming with trees and bananas is for land users, land use change and environmental protection. Lands are protected and adapted for adoption, in permanent land cover with trees and bananas. ELUP thus improves nutrient use, and stabilizes and protects land, creating agro forestry and environmental overlaps.

Keywords: *Effective land use planning (ELUP), Land use, South Western Cameroon (SWC), Sustainable development (SD)*

NUTRITIONAL STATUS AND GROWTH OF BEECH (FAGUS SYLVATICA L.) SEEDLINGS EXPOSED TO DROUGHT IN A FERTILIZATION EXPERIMENT

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Abstract

The increased frequency of droughts caused by climate change is a challenge for the survival of common beech. Reduced water and nutrient availability caused by drought have a negative impact on growth, while optimum nutrient levels can improve the overall health status of young trees. Still, the potential role of mineral nutrition in alleviating the negative impacts of drought stress on *F. sylvatica* seedlings has not been sufficiently studied. To determine these effects, one-year-old beech seedlings were placed in a greenhouse and exposed to different watering (regular and drought) and fertilization treatments (higher and lower doses). Height and root collar diameter of beech seedlings were measured at the beginning and the end of the growing season. Samples for foliar analyses were collected before drought, at the peak of drought, and after re-watering. Aboveground and belowground biomass was determined at the end of the growing season. The effect of fertilization on foliar concentrations of N was significant, regardless of water availability, but more pronounced in combination with regular watering. Fertilization had a positive effect on foliar P concentrations regardless of imposed water limitation, both in the drought and recovery phase. A differing height and diameter increment response was noted, with both fertilization and watering impacting diameter increment. Seedlings in drought treatment with low fertilization dose invested more into root growth reflecting the plasticity of common beech in terms of its ability to withstand drought stress.

Keywords: *Common beech, Drought, Fertilization, Nutrition.*

MICROPROPAGATION AND *IN VITRO* CONSERVATION OF NARROW-LEAVED ASH IN CROATIA

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Abstract

Narrow-leaved ash (*Fraxinus angustifolia* Vahl.) is one of the most important tree species in the lowland floodplain forests of the Republic of Croatia. In recent years, increased dieback of narrow-leaved ash has been noticed in Europe, but also in the entire territory of the Republic of Croatia. Tree dieback in forest stands of all ages in some localities creates major environmental and economic problems and classifies this species as one of the most endangered at the moment. Climate change and groundwater and flood disturbance have led to physiological weakening of narrow-leaved ash. After the appearance of the pathogenic fungus *Hymenoscyphus fraxineus* (T. Kowalski) Baral, Queloz & Hosoya in interaction with other pathogens, rapid dieback of this tree species has occurred. The aim of this research was to develop protocol for micropropagation of narrow-leaved ash and conservation of potentially resistant individuals *in vitro*. This would enable fast and successful propagation of the most resistant and high-quality narrow-leaved ash trees, which would contribute to the conservation of this species due to climate change and attacks of pathogens and pests. Some potentially resistant trees have been found in forest stands and they served as a source of plant material for micropropagation. Several protocols have been tested and three of them have shown promising results. The resistance of cloned seedlings will be tested in the continuation of the research. The developed technology may be used for mass propagation of common ash superior trees.

Keywords: *Dieback, Fraxinus angustifolia, Gene bank, Tissue culture*

CLIMATE SMART FARMING IN COFFEE AGROFORESTRY SYSTEM IN SIDAMA, ETHIOPIA

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Abstract

The coffee value chain particularly in east Africa is facing different problems such as low productivity due to a lack of climate-smart farming and weak local vertical and horizontal value chain linkages and upgrading. Thus, this paper was aimed at investigating the climate-smart farming and factors affecting implementation among stallholders in coffee-dominated agroforestry system. Cross-sectional data were collected from 360 coffee farming households. Information was generated by using descriptive statistics, Coefficient Variation (CV), and an econometric model. Findings show the mean annual maximum and minimum of rainfall were 991.95 and 1492.63mm in the study area. In the fast three-decade, the mean annual maximum (991.95mm) and minimum (1492.63mm) of rainfall recorded in coffee-dominated farming systems with CV was less than 11% and indicate that there was low inter-annual variability. The mean annual minimum and maximum temperatures were 8.36°C and 27.05°C, respectively, with CV being less than 0.046°C showing there was a slight increment in temperature. Moreover, in the upper watershed, a lower variation in rainfall and temperature was recorded when compared with the lower part of the watershed in the coffee-dominated farming system in Ethiopia. The likelihood of production and supply decreased during the bad season by 57.31% and 66%, respectively. But the trends of coffee area harvested increased from 0.116 to 0.1294 million ha over the last eight years, and total production from 1.007 to 1.231 million tons; average coffee productivity (0.95 tons ha⁻¹) and still it was 31% less than top coffee-producing countries. The main identified climate change smart or improved management practices include the use of improved coffee varieties, site cultivation, establishing windbreaks/shelterbelts, stumping, shade tree management, organic compost application, pruning, intercropping coffee, spacing (planting density), soil moisture content management, mulching, and weed control practices. Climate-smart farming among smallholder farmers in a coffee-dominated agroforestry system was influenced significantly by weak market access and market orientation, lack of resources; lack of inputs; inadequate infrastructure; weak institutions support, and governance forms. The future coffee extension service focus on climate-smart farming or improved management practices as per recommended standards simultaneously. These smart farming is expected to drive triple advantages such as increased coffee productivity and beans quality and climate resilience outcome/impacts in the Arabica coffee-dominated farming system in Ethiopia.

Keywords: *Arabica coffee production, Climate smart farming, Coefficient Variation, coffee Value chain upgrading practices*

EU-LIFE FUTURE FOREST PROJECT: MONITORING METHODS FOR QUANTIFICATION OF ECOSYSTEM SERVICES OF permanent FORESTS

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Abstract

The FutureForest project examines the forest area of the county of Landsberg am Lech in southern Bavaria. From a previous 80% of coniferous forest back in 1980, the area has been altered with deciduous trees species to permanent forests with levels under 60% which show high levels of ecosystem services (ESS). The reduction of coniferous wood involves a monetary loss for the owners but a growth in ESS. This paper will highlight the methods used to examine fundamental key data for quantifying ESS of forests. Calculating the entire biomass growth potential of the seven most used tree species in the area, all compartments, such as leaves, branches, bark, trunk and stem, were examined. To complete the biomass growth examination, fine root masses were analysed to a depth of 30 cm. Based on this data, the cooling capacity of forest stands can be calculated. To obtain detailed evidence of temporal biomass growth, 35 dendrometers were installed in the project area. A combination of dendrometer data and precipitation data can be used to identify the dependence of tree species growth on precipitation and the stability for future drought periods. Another factor for stabilisation of forest stands is a functioning nutrient and water balance, which can be derived from the earthworm abundance in the soil. In the project, earthworm analysis was carried out in different stands on a random basis. Combining the data named above, ESS can be estimated to generate a validation system for compensating the monetary loss of the forest owners.

Keywords: *Ecosystem services, permanent forests, fine roots, cooling capacity, earthworms*

SANDY GRASSLANDS ALONG THE DANUBE IN THE CARPATHIAN BASIN

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Abstract

We examined the sandy grasslands appearing in the steppe-forest-steppe vegetation, in the central part of the Carpathian Basin along the Danube. We studied the grasslands in terms of coenology, putting great emphasis on dominant *Festuca* taxa. The survey was conducted on 4 different locations in the Carpathian Basin. Cover of dominant grass species was used as indicator value. Pedological background was also examined. *Festuca vaginata* grassland is an open vegetation type based on its coenosystematic composition and ecological values. It grows on a very weakly developed calcareous soil with sandy texture, the lowest organic carbon (0,2%), and the highest carbonate content (11,3%). Where grasslands had been disturbed, *Festuca pseudovaginata* and the recently discovered *Festuca tomanii* appeared. These taxa were also found in forest patches. The soil under *Festuca pseudovaginata* was more developed, in the surface horizon with higher organic carbon content (1,1%) and lower carbonate content (6,9%). *F. pseudovaginata* is endemic in the Pannon region. The most developed soil profile under *Festuca wagneri*, the presence of deep, the humus rich soil material from deflation and degradation. Due to significant changes in the vegetation in the last few hundred years, the central sandy grassland, forest-steppe areas of the Carpathian Basin have become mosaic-like, but the present survey affirmed that several patches of the original vegetation have remained. The dominant *Festuca* taxa of these vegetation types are good indicators of the changes in the vegetation and their ecological background.

Keywords: *Festuca vaginata*, pedological analysis, diversity

MORPHOTAXONICAL INVESTIGATION OF FESTUCA TAXA ACCORDING TO HORTICULTURAL APPLICABILITY

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Abstract

During this survey, two potentially horticulturally usable *Festuca* species was analysed: *Festuca wagneri* and *Festuca tomanii*. The main questions were the following: are they usable in an urban environment? Specimens of the two taxa, which were planted either into normal garden soil or into pots differed greatly. 30 specimens of each taxa were planted into similar environment for the sake of taxonomic and morphologic analyses. *Festuca tomanii* specimens were uniform, but *Festuca wagneri* formed clearly distinguishable taxonomic groups. Specimens of *Festuca tomanii* were usually larger and more uniform. Though the average lengths of leaves and inflorescence stems tended to be higher on the soil mixed with perlite, the coverage values were lower on it. Several types were selected from them, which could be useful in horticultural practice. These were named and described as such: 1. leaves and inflorescences both stand up densely; 2. generative shoots bend apart; 3. dense but short „dwarves”; 4. Very tall with spreading inflorescence with a particular lilac, antocianic colour on the nodes. These groups were expanded with the colour of the specimens, so green, grayish and silvery variants can also be separated. The tissue differences were in line with their horticultural decorative values and the differences in the inflorescence parameters. The diversity of *Festuca wagneri* showed well in this survey, and this taxon's parameters would be also useful in horticultural practice. The survey was supported by OTKA K-125423.

Keywords: *Festuca wagneri*, *F. tomanii*, tissue

LONG-TERM DYNAMICS OF SUBCANOPY LAYER AS NEW LAYER IN AN OAK FOREST OF HUNGARY

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Abstract

Structural dynamics of the shrub layer were analysed in a Hungarian oak forest after the serious oak decline pandemics. Vertical foliage distribution changed in the understory and a new subcanopy layer appeared below the oak canopy in the last decades. This paper focuses on the following questions: (1) how have the new foliage layer developed after oak decline? (2) Which woody species are the most frequent in this layer? (3) How have the mean sizes of these species changed? The forest association in the monitoring site is *Quercetum petraeae-cerridis* with *Quercus petraea* Matt. L. (sessile oak) and *Quercus cerris* L. (Turkey oak). The site was subdivided into 144 permanent subplots. Woody individuals were classified as subcanopy trees between 8.0–13.0 m in height. Measured structural parameters were carried out in the period 1982–2017. Three woody species, *Acer campestre* L. (field maple), *Acer tataricum* L. (Tatar maple) and *Cornus mas* L. (European cornel) played a key role in the new layer and their height was between 8.0–13.0 m or higher than 13.0 m. The density of species in this layer increased considerably between 1982 and 2002. The most frequent woody species was *A. campestre*. The mean height, diameter and mean cover of the dominant woody species increased significantly after the decreasing oak density. Our results suggest that the mixed oak forest responded to oak decline with significant structural rearrangement in the shrubs and three woody species compensated for the remarkable foliage loss in the canopy. These species formed a new subcanopy layer.

Keywords: *Shrub community, Oak decline, New foliage layer, Acer campestre, Dominant woody species.*

A TOOL FOR ECOSYSTEM SERVICES AND DISSERVICES ASSESSMENT IN URBAN FORESTS: THE CASE OF THE REAL BOSCO DI CAPODIMONTE, NAPLES

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Abstract

A tool for urban forest Ecosystem services (ES) and disservices (ED) assessment has been developed to assess (i) overall ES-ED value, (ii) ES-ED trade-off and (iii) explore principal influences in ES and ED provision. The Real Bosco di Capodimonte (Naples, southern Italy) was chosen as site for the study and application of this tool. ES and ED linked to urban forest plant cover were: biodiversity, carbon storage, carbon sequestration (gross and net), avoided runoff, oxygen production, air pollution removal, UV reduction, pollen-related allergenicity risk, volatile organic compounds (VOCs) emissions. A phytosociological survey was conducted and biodiversity value was evaluated. ES and ED were assessed by i-Tree Eco model and Index of Urban Green Zones Allergenicity (I_{UGZA}). Results highlighted that 441 different plant species occur in the Capodimonte Park and the most represented genera are *Quercus* and *Trifolium*, while the largest family was Asteraceae. Carbon storage and air pollution removal were highest in natural forest, while other ES were greater in managed forest areas. Highest value for VOCs emission and allergenicity were assigned to managed and natural forest, respectively. Average ES-ED score calculation showed managed forest the highest value and managed grassland the lowest. Results highlighted the greater influence of plant cover structure in overall ES and ED provision levels, and management influence considering the same type of plant cover. The model could provide a valuable tool for ES and ED effective management in urban forests.

Keywords: *Ecosystem services, Ecosystem disservices, Carbon sequestration, Urban forestry*

SELECTION AND PROPAGATION OF SWEET CHERRY PROMISING CLONES IN CLIMATIC CONDITIONS IN LATVIA

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Abstract

In Latvia, sweet cherry (*Prunus avium* L. syn. *Cerasus avium* (L.) Moench) as a forest tree species is becoming quite common growing as individual trees or in small groups. In this study, Latvian State Forest Research Institute “Silava” Plant physiology laboratory has established the first collection of promising sweet cherry clones from different regions of Latvia, which currently has 45 accessions. These are clones suitable for selection, propagation and cultivation in Latvia climate conditions to obtain trees with high-quality trunks and wood stock. Sweet cherry accessions are selected from twelve districts in northern, southern and western regions of Latvia, because the heterogeneous climatic conditions observed in Baltic states due to the proximity of the Baltic Sea may affect the results. Besides it, promising introduced clones has been investigated – the clone from Denmark (Truust 791) as well as the three clones from Sweden (nr. 9., 10. and 13). The method for successful micropropagation of selected clones has been fully developed including sample collection, explant preparation, sterilization, medium composition for the culture establishment, propagation and rooting, and further monitoring of explants until transplantation into a suitable substrate. The method for the propagation by leafy cuttings has also been developed. The mycorrhizal preparation “Symbivit” has been tested, to assess whether the use of this product improves the efficiency of cherry propagation. The treatments with IBA (indole-3-butyric acid) and lignosilicon were used for rooting stimulation. The treatment with IBA resulted in a higher proportion of cuttings which formed the callus than treatment with lignosilicon - 98% and 68%, respectively.

Keywords: *wild cherry, local clones, introduced clones, micropropagation, leaf cuttings.*

USE OF BY-PRODUCTS IN FORESTRY AND AGROFORESTRY SYSTEMS AS ALTERNATIVE TO MINERAL FERTILISERS

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Abstract

The use of by-products as plant fertilisers is a sustainable alternative to mineral fertilisers and part of circular bioeconomy. This fertilisation method offers various benefits, for instance the sustainable utilization of waste products, lower cost of soil conditioning, and better impact on the ecosystem than mineral fertilisers. While few by-product fertilizers in the market are present long enough, others are not so well known. In addition, most studies focus on crops. The use of by-products for food crop fertilisation, is not always recommended, because they may contain too high concentrations of heavy metals, but their use for soil conditioning has potential in tree plantations. The intent of this study was to determine the potential use of different by-products for tree fertilisation in short-rotation forest and agroforestry systems. The effect of three different industrial by-products was investigated in laboratory experiments: the effect of biogas digests and wood ash mixture on *Populus* spp. clones, the effect of bio-compost on the crops suitable for intercropping in agroforestry systems, and the effect of the non-industrial peat fraction and wood ash on the *Salix* spp. clones. Application of biogas digestate and wood ash fertiliser significantly increased morphological parameters of shoots of poplar cuttings and extended growth period. The use of bio-compost in agroforestry also showed increased growth of industrial plants for intercropping. As well, fertilising with non-industrial peat fractions, improved the growth rate for shoots of *Salix* spp. cuttings. The results showed that the use of by-products as a soil additive improves tree growth.

Keywords: *peat, bio-compost, biogas digestate, wood-ash, tree plantation.*

PRODUCTIVITY OF SALIX SPP. CLONES GROWING IN A FIELD TRIAL IN LATVIA

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Abstract

Willow (*Salix* spp.) family is one of the fastest-growing woody energy crop. It has widely used for biomass production in short-rotation forestry and carbon sequestration in longer rotation. Willows also have a high accumulation rate for macro and micronutrients, therefore they can be used as phytoremediation plants in Northern Europe. Willows are well propagated by planting un-rooted cuttings and they could be cultivated on a wide range of soils. This study investigated 13 commercial willow clones (Bella, Birgit, Emma, Erik, Estelle, Ester, Lisa, Monika, Olof, Sven, Visvaldis, Wilhelm, Winter) and six experimental *Salix alba* clones (0218B, 0206L, 0207M, 0208N, 0211S, 0214W) which grows in field trial location in Latvia, Kalsnava (56.68764N, 25.93907E). Four years after planting aboveground dry mass of willow clones was measured with a destructive method (harvest, weighing, and determination of wood dry matter content). Individual plant dry mass was determined for the five most productive commercial willow clones, but the average dry mass was calculated for others willow clones. One year after willow harvesting, the amount of reproductive material for commercial willow clones was determined. Results showed that Birgit ($2,3 \pm 0,2$ kg) and Sven ($2,1 \pm 0,2$ kg) clones had the highest average aboveground dry mass. *Salix alba* clones had less dry mass than commercial willow clones. The largest reproductive material amount with a cutting length of 20 cm was provided by commercial clone Birgit – 51 cuttings, Ester – 49 cuttings, Emma – 32 cuttings, and Visvaldis – 30 cuttings.

Keywords: *Willow clones, Dry mass, Salix alba, Reproductive material.*

DOES SOIL TILLAGE BEFORE AFFORESTATION CONTRIBUTE TO HIGHER CARBON STOCKS?

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Abstract

Afforestation of former agricultural land contributes to the higher carbon (C) stocks in aboveground biomass and dead organic matter. Soils contain major C stocks and are of great importance for C sequestration. Soil preparation prior to planting tree seedlings, especially if deep soil cultivation is applied, causes significant disturbances in the soil profile. Therefore, the afforestation can alter organic C budgets, both in soil and forest biomass. This study analyzed the influence of deep soil tillage up to 40–60 cm depth on the SOC stocks in Arenosols (20 years post afforestation) and Planosols (10 years post afforestation) of Scots pine plantations in comparison to non-ploughed soils in naturally regenerated Scots pine stands. The samples of forest floor and mineral soil in different layers up to 80 cm depth were analyzed. The results showed no differences in forest floor C contents between deep ploughing and non-ploughed sites. The SOC stocks increased at deeper mineral soil layers in relation to the upper mineral soil layers. The total SOC stocks, calculated by summing the SOC values obtained in forest floor and mineral soil layers up to 80 cm depth, were higher in deep ploughing sites than in non-ploughed sites. Therefore, this demonstrated the positive effect of deep soil tillage not only on SOC retaining in the deeper soil layers but also showed the continuous SOC accumulation in the new topsoil. Potentially, soil C sequestration in the deeper layers for a longer period could also be important in the context of climate change.

Keywords: *deep ploughing, organic carbon, carbon concentration, carbon stock.*

WILDLIFE HABITATS IN AGRICULTURAL LANDSCAPE AND ADAPTATION

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Abstract

Continuing human-induced landscape changes result in habitat loss, increased isolation between landscape fragments and new disturbance types that challenge wildlife populations. These changes include large farms, increased field sizes, promotion of monocultures and improvements in agricultural infrastructure. In such situation, early successional vegetation around agricultural fields like shrubs, grasses, weeds, and forbs provide food and cover for many species of wildlife and are the important habitat component for their survival. Wildlife has adapted to these edge habitats, which are created at the interface of two or more plant communities, such as the transitional zone between a woodland and crop field or pasture. We aimed to ascertain the adaptability of wildlife species in the mixed forest – agricultural landscape and their preference in habitats depending on the local abiotic and biotic factors. The study was performed in the main five natural regions of Lithuania using the integrated belt transect (100 m x 4 m) and sample plot (50 m x 2 m) method. Simultaneously, we examined the long-term data on wildlife abundance in the different counties using our database. Animals respond through the flexibility of their behaviour. Three ecotypes of roe deer (*Capreolus capreolus* L.) and brown hare (*Lepus europaeus* Pallas), namely, “field”, intermediate, i.e., “field-shrubs“ and “forest” ecotypes, were determined in Lithuanian landscape depending on the share of forest cover (7-20%, 21-40 and 41-84%, respectively).

Keywords: *Landscape changes, Wildlife, Adaptation, Ecotypes, Forest cover.*

THE VIABILITY OF BEECH SEEDS (*FAGUS SYLVATICA*) ORIGINATING FROM THE REPUBLIC OF MOLDOVA UNDER HIGH POSITIVE TEMPERATURES

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Abstract

Under the conditions of the ongoing climate change, the ripening seeds of the beech *Fagus sylvatica* L. in the Republic of Moldova during the autumn period are exposed to long-term effects of the high temperatures, which may adversely affect their germination. The purpose of our research was to study the effect of different doses of supraoptimal temperatures on the viability and germination of *Fagus sylvatica* seeds harvested in 2021 from Hîrjauca, the Republic of Moldova. The viability of beech seeds was determined by two rapid tests: a) evaluation of enzyme activity by 1.0% of 2,3,5-triphenyltetrazolium chloride (TTC); b) forced germination by 1% hydrogen peroxide (PH), which have the good correlation (Pearson coefficient 0.8281). Initial viability of beech seeds was 80.0 by TTC and 79.0% by PH test. The beech seeds were exposed to short times (30, 45, 60 min) heat at 50°C and 60°C. The significant decrease in viability by 39% was establish after seed treatment at a temperature of 60°C for 30 min ($LSD_{0.05}=16.58$, $p<0.05$). At the same time the roots length of survived seeds germinated during seven days in hydrogen peroxide slightly increased from 0.46 cm to 0.53 cm ($LSD_{0.05}=0.07$, $p>0.05$). The heat treatment at minimal tested dose (50°C for 30 min) before the stratification led to a decrease in viability and germination rate of beech seeds. After two months of germination in coconut substrate, the emergence was only about 18.5%. The roots length of survived seeds after heat treatment did not differ significantly from intact seeds ($LSD_{0.05}= 0.34$, $p>0.05$).

Keywords: *Fagus sylvatica*, seed, viability, germination, high temperatures.

PRESENT AND FUTURE AGROFORESTRY LAND SUITABILITY ANALYSIS IN CENTRAL PORTUGAL USING MULTICRITERIA DECISION ANALYSIS

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Abstract

The expansion of monoculture tree plantations typically made up of pine or eucalyptus trees, is a main problem in Portugal. In recent years, monoculture plantations have spread across the country, driven by the pulp and paper industry. These are generally more susceptible to the spread of fire than mixed forests or agroforestry systems, which among other advantages, hold more water and reduces soil erosion. A diverse landscape with a mosaic of different uses and vegetation cover types provides a greater bulwark or natural barrier against large-scale and uncontrollable forest fires. The objective of this study is to determine the suitability for species cultivated in an agroforestry mode in the *Pinhal Interior Sul* region, as an alternative agricultural system, based on the analysis of the soil and climate limiting factors. For this purpose, the biophysical criteria determining the cultivation of common oak (*Quercus robur* L.), cork oak (*Quercus suber* L.), strawberry tree (*Arbutus unedo* L.), and sweet chestnut (*Castanea sativa* Mill.) were processed using a Geographic Information System for the present time and in the face of two future emission scenarios. The analysis was performed by the Analytical Hierarchy Process (AHP). After dividing the problem into hierarchical levels of decision-making, a pairwise comparison of criteria was performed to evaluate the weights of these criteria. The process was completed by validating the consistency of these operations. The AHP was adequate in the evaluation of the tree species' suitability allowing the integration of different criteria. It is therefore essential to be aware of the suitability and resilience of agroforestry systems to meet the need to adapt to climate change.

Keywords: *Agroforestry, Land suitability, Analytic Hierarchy Process, GIS.*

ASSESSING THE GENETIC VARIABILITY OF EUROPEAN LARCH IN ROMANIA. IMPLICATION FOR FOREST MANAGEMENT

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Abstract

European larch (*Larix decidua* Mill.) is one of the most important coniferous species in Romania. Its natural distribution area in Romania is discontinuous and very limited compared with other coniferous species, representing only 0.3% of the forest area. Natural area of European larch in Romania is concentrated in Ceahlău, Ciucaș, Bucegi, Lotru and Apuseni Mountains (covering 4500 ha). Despite its restricted natural distribution and lower percentages in artificial stands compared to pine and spruce, European larch has been the subject of numerous studies. With the international collaboration, a series of comparative trials using foreign and Romanian provenances of larch was established in 1982. The main objective of our study was to assess the genetic variability of the economic and adaptive traits among larch provenances, tested in two field trials, in order to select the best provenances in terms of growth traits, stem straightness, and survival, and to investigate the phenotypic correlations among traits, and genotype vs. environment interaction. Our findings, based on provenance trials, indicate a wide interpopulation genetic variation in European larch. The environmental factor was also significant. Consequently, the response of the species to climate change will depend on the environmental conditions of the planting site but also on the provenance. Knowledge of the geographical genetic variation of this species is becoming increasingly important in the context of climate change, in order to establish the appropriate strategies for the conservation of forest genetic resources, to improve species adaptability to climate change, and to continue the larch breeding program.

Keywords: *European larch, Genetic variability, Forest genetic resources, Provenance trials, Phenotypic correlations.*

IOT MONITORING OF QUERCUS ROBUR TREES IN BOSUT FOREST, SERBIA

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Abstract

Bosut broadleaf forest formed on the alluvial plain of three rivers is one of the largest oak forests in Balkan Peninsula. Global climate change and anthropogenic load led to changes in the hydrological system of surrounding river, causing forests water table lowering and increase in forest dieback. To monitor physiological state of the Bosut forest oak trees in real time, 20 TreeTalker devices was installed in August 2021 in central part of the forest. Air and wood temperature and humidity, radial growth, sap flux density and spectral parameters of canopy was measured on hourly basis and collected on remote server. Highest air temperatures under trees canopies and the most distinct diurnal temperature dynamics was detected in August (15-26 C range), while the lowest temperatures and the less distinct diurnal dynamics was observed in December (0-7 C range). Air relative humidity under canopies had no pronounced diurnal dynamics, while varied significantly between different studied trees and months of observation. Sap flux had clear diurnal and seasonal dynamics with high variety of absolute values between trees (2-10 l/h range). Real time monitoring of oak trees canopies spectral parameters showed that chlorophyll degradation in leaves started in September, with defoliation in October-December period. Observed in summer months sap flux values was quite low and since very low correlation between sap flux and climatic factors (T_{air} , RH) were observed ($R^2 < 0.2$) with no signs of leaves stress, water availability to the roots may be a major limiting factor.

Key words: Robur trees, Serbia.

ECOLOGICAL ASSESSMENT OF SOIL CO₂ EMISSIONS IN POST-AGROGENIC SUCCESSION OF FALLOW OVERGROWTH BY FOREST ON PODZOLUVISOLS

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Abstract

Global climate change is one of the key environmental problems of the XXI century. Deforestation and reforestation are the most important changes in land use that determine the intensity of soil CO₂ emission. About 30 million hectares of agricultural land are not used in Russia since 1990-s, and most of them are in the southern taiga zone with Podzoluvisols. Fallow lands are the main territorial reserve for both increasing agricultural production and ecological restoration and expansion of the RF natural forest framework. There are results of Podzoluvisols CO₂ emission monitoring within post-agrogenic succession of fallow overgrowth by forest in the representative southern-taiga zonal ecosystems of the Central Russia. Five sites with succession stages from a perennial meadow to 100-year spruce forest are located compactly (within 300 m transect) on geomorphologically comparable slope landscapes in the Central Forest Reserve. The intensity of the soil CO₂ flux, temperature and soil moisture were determined weekly in the warm period of the year and once a month in the cold period. A mobile infrared gas analyzer Li-820 was used to analyze the soil CO₂ fluxes. Year-round studies were conducted in conditions of the biosphere reserve - regional southern-taiga reference object. They revealed statistically significant seasonal and succession tenfold and two - fold dynamics of soil CO₂ emission of Podzoluvisols in the main environmental types of the southern-taiga land-use. It should be considered in strategic land-use planning to achieve the stated goal in Glasgow of a phased transition to C-neutral development of the RF regions.

Keywords: *Post-agrogenic succession, Fallow overgrowth by forest, Soil CO₂ emission, Podzoluvisols, Russia*

DEEP-PLANTED WHIPS ARE GOOD ALTERNATIVE TO ROOTED CUTTINGS IN THE ESTABLISHMENT OF WHITE POPLAR CLONAL PLANTATIONS

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Abstract

The effect of different planting types and depths on diameter at breast height, plants' height, and survival rate were analyzed in three trials established on soil with a favorable water regime in the first two growing periods. A similar survival rate was achieved by the planting of whips at depth of 2.5m ("deep planting") as by commonly practiced planting of rooted cuttings at depth of 0.8m. The survival rate of whips planted at depth of 2.5m did not decrease significantly during the second growing period. However, better growth in the first two growing periods had been achieved in the plantation established by whips planted at 2.5m than by rooted cuttings planted at 0.8m. Examined clones achieved high survival rate, both in the plantation established by one-year-old whips planted at depth of 2.5m, or by one-year-old rooted cuttings planted at 0.8m. Two-year-old whips achieved higher survival rate and better growth in diameter in the second growing period than two-year-old rooted cuttings, while the difference between those two treatments and the establishment by one-year-old whips was not significant. The survival rate of one-year-old whips planted at 0.8m was significantly lower than the survival rate of one-year-old rooted cuttings planted at the same depth but was not significantly lower than that of one-year-old whips planted at 2.5m. The research should be continued since the establishment of white poplar clones by deep-planted whips could significantly improve white poplar wood products, especially considering the benefits of production of planting material in stool beds in comparison to the production of rooted cuttings.

Keywords: *Populus alba*, deep planting, planting material, stool bed.

ECOLOGICAL CHARACTERISTICS OF GREEK MAPLE (*ACER HELDREICHII* ORPH.) IN PRIMEVAL FORESTS „PERUĆICA“ AND „BIOGRADSKA GORA“

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Abstract

Greek maple (*Acer heldreichii* Orph.) is subendemic of Balkan Peninsula and tertiary relic, with westernmost distribution border in Bosnia and Herzegovina. This paper deals with ecological conditions (climate, parent rock, soil and vegetation) on its sites in two primeval forests - „Perućica“ on Maglić Mt. within national park „Sutjeska“ in Bosnia and Herzegovina and „Biogradska gora“ on Bjelasica Mt. within national park Biogradska gora in Montenegro. Elevation of Greek maple sites is 1400 m-1700 m a.s.l, aspects are N and NE, and inclination 5-20°. Climate is in both localities moist temperate with cold winters according to Köppen classification, and perhumid according to Thornthwaite. Geological parent rock is hard limestone on Perućica, and marly limestone and sedimentary breccia on Biogradska gora. Soil type on Perućica is kalkomelanosol (leptosol), and kalkocambisol on Biogradska gora. Soils are shallow to moderately deep, with mildly acidic to neutral reaction, well supplied with nitrogen and potassium, and poorly provided with phosphorus. Greek maple grows within altimontane beech forest zone on both localities and is codominant species of mixed beech-Greek maple forest community (*Aceri heldreichii-Fagetum* B. Jov. 1957). Based on ecological spectra, this community is mesic according to moist requirements, neutrophilous according to soil reaction, tolerant according to light requirement, mesotrophic according to nitrogen requirement, and according to warmth it is mesothermic. Hemicryptophytes dominate in spectrum of life forms, with high geophytes content. Dominant group in spectrum of floral elements is Central European group, followed by Euroasian, as well as Circumpolar and Cosmopolitan group.

Keywords: *Acer heldreichii*, endemic, ecology, Perućica, Biogradska gora

SUPPRESSION OF DUSKY CLEARWING (*PARANTHRENE TABANIFORMIS* ROTT.)

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Abstract

Dusky clearwing (*Paranthrene tabaniformis* Rott.) presents a significant pest in nurseries and juvenile poplar plantations. To study the possible options for its suppression, two different experiments were conducted: (i) use of diflubenzuron (Dimilin SC 48) insecticides with added paraffin oil (Letol EC) and alpha-cypermethrin (Fastac Forst) without added paraffin oil for treatment and (ii) injecting gasoline into the caterpillar holes. First experiment was established at the experimental estate of the Institute of Lowland Forestry and Environment in a two-year poplar plantation as a randomized block design aiming to study the possibilities of control. A handheld sprayer was used for application of insecticides in two terms: on May 20, 2021, and June 17, 2021, by spraying the bark of the tree thoroughly from the ground to the start of the crown. On September 8, 2021, the experiment was evaluated by counting the boreholes made by the larvae of the dusky clearwing. Second experiment included suppression of the dusky clearwing caterpillars by injecting gasoline into the caterpillar holes that was conducted in the second half of July and the beginning of August 2018. The applied insecticide alpha-cypermethrin had an effectiveness of 84.2%, while the usage of diflubenzuron with added paraffin oil had an effectiveness of 83.3%. The injection of gasoline into the larvae holes was 84.8% effective. High efficacy of applied insecticides in preventing plants from attack of dusky clearwing and injecting gasoline into caterpillar holes on plants suggests that these measures might be effective in protection of young poplar plantations against dusky clearwing attacks.

Keywords: *Paranthrene tabaniformis*, *Suppression*, *Insecticides*, *Gasoline*, *Injecting*.

POPULATION DYNAMICS OF EARLY OAK DEFOLIATORS IN CORRELATION WITH MICRO-CLIMATIC TEMPERATURE CONDITIONS IN KRAGUJEVAC AREA IN SERBIA

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Abstract

Forest dieback that comes in waves since the early 20th century has lately grown into an epidemic, in particular in oak stands. For this reason, research was conducted of the population dynamics of early oak defoliators, which represent a grave danger in oak stands due to their gradogenic attributes. The research was carried out over a 5-year period in oak forests in the area of forest administrations Kragujevac and Gornji Milanovac. The samples used in the research were collected from bottom branches, where Geometridae were found in the largest numbers, as well as from the mid and upper parts of the crowns, where other species were found. Population levels of these pests were presented in laboratory conditions on winter branch samples and in newly foliated stands on site, depending on the basic parameters of the climatic conditions. The greatest deviation of the population level of early oak defoliators was noted in 2018 on all 6 presented localities through the analysis of winter branches and the analysis of their presence in newly foliated stands on site, and it was followed by the highest average air temperature.

Key words: *defoliators, oak, population level, forecast of attacks.*

BIOPOTENTIAL OF INTRODUCED FALSE INDIGO AND ALBIZIA WEEVIL IN HOST PLANT CONTROL AND DURATION OF ITS DEVELOPMENT STAGES IN SOUTHERN REGIONS OF PANONIAN BASIN

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Abstract

The paper present results of the entomological experimental studies of the biological, ecological and (bionomic) insect performances such as seasonal adaptation of introduced monophagous false indigo and albizzias weevil's *Acanthoscelides pallidipennis* Motschulsky. and *Bruchidius terrenus* (Sharp), Coleoptera: Chrysomelidae: Bruchinae, to phenological phases of aggressive invasive host plant *Amorpha fruticosa* L. on territory of Republic of Serbia with special attention on assessing and monitoring of new formed and detected inter species relations between autochthons parasite wasps from fauna (Hymenoptera: Chalcidoidea) and herbaceous seed weevil beetle. During 15 years (2006-2021) on approximately 30 localities data analyses were done for observed experimental host plants from samples with statistical significance. Status of genera from families Hymenoptera: Chalcidoidea.: Pteromalidae and Eulophidae after intensive investigations has been trophicly identified. Recorded seed pest species of *A. fruticosa*, or *A. julibrissin* (Fabales: Fabaceae) was introduced in Serbia, and planted as ornamental trees, also were put undergo different kinds of laboratory and field research tests during this period in a goal of collecting data about lasting each of develop stage of their seed beetles. Field generations in different stages were also monitored by continuous infested seed collecting and its dissection. Established host plant-seed predator linkage was observed in correlation with different environment parameters, especially water level fluctuations in bank corridor formation stands and riparian cultures.

Keywords: pods, *Amorpha*, *Albizia*, weevil, Chalcidoid wasp, herbivores, Serbia.

PROPERTIES AND POSSIBILITIES OF FORESTATION OF NON-AGRICULTURAL SOIL IN THE AREA OF SREM IN SERBIA

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Abstract

The paper presents the characteristics of soil in the lowland agricultural area of Srem in Serbia, which is not used for agricultural production. The research was carried out on three areas in the area of the village Surduk with an area of 16.69 ha. Three pedological profiles were opened in the study area and their external and internal morphology was described. Samples of disturbed soil were taken from pedological profiles and standard physical and chemical analyzes were performed. The type of carbonate chernozem soil on the loess plateau was determined. The granulometric composition of the soil indicates a slightly higher share of total clay in relation to the total sand, and the texture class of loam predominates. Carbonation increases with depth and the examined soil belongs to strongly carbonate, neutral to weakly alkaline reactions. The humus content is the highest in the powerful humus horizon, ranging from 2.06 to 2.54%, and can be classified as moderate humus soil. Having in mind the favorable granulometric composition, the amount of humus and the stable crumbly structure, this soil has a very favorable water-air regime. The examined soil is of great production value for raising hardwood forest plantations.

Keywords: *Non-agricultural soil, afforestation, Srem.*

CHARACTERISTICS OF MEADOW BLACK SOIL IN THE AREA OF NORTHERN BAČKA IN SERBIA

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Abstract

The paper presents the physical and chemical properties of meadow black soil. The research was conducted in the geographical area of the northern part of Bačka in Vojvodina province, Republic of Serbia. The survey covered the areas of the villages of Stari Žednik, Đurđin and Bikovo. The granulometric composition of the examined pedological profiles shows the largest share of the fine sand fraction, which on average ranges from 46.29 to 51.68%. The average content of total sand is from 46.64 to 52.27%, ie the content of total clay is from 47.73 to 53.36%. The textural classes of the examined soils are: sandy loam, loam, sandy clay loam and clay loam. The CaCO₃ content of these soils ranged on average from 3.03 to 8.47%, which classifies them as medium carbonate to carbonate soils. Values of pH increase with depth, and range on average from 7.26 to 8.26, which classifies these soils as neutral to moderately alkaline soils. The humus content is the highest in the surface humus horizon and ranges from 1.24 to 3.50%, ie in this horizon the examined soil in the class is weak to moderately humus. The average values of humus for the entire depth of the profile are in the range of 0.44 to 2.03%, ie in classes from weak to moderately humus soils. The nutrient content indicates that the examined soils are in the range from medium to well supplied with nitrogen, moderately provided with easily accessible phosphorus and poorly provided with easily accessible potassium. The examined granulometric composition indicates favorable water-air properties of these soils. The examined soils have high production capacities, and are mostly used for agricultural production, while to a lesser part they are used for the production of certain types of hardwoods.

Keywords: *Meadow black soil, Granulometric composition, Chemical properties, Production capacity.*

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CHANGES IN THE FLORISTIC COMPOSITION OF BEECH FORESTS (*FAGUS SYLVATICA* L.) AT TWO SITES IN SOUTHEASTERN SERBIA OVER A PERIOD OF 14 YEARS

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Abstract

European beech forests are generally poor in species. However, the composition and richness of vascular plants in these forests vary with region and site. Numerous factors can cause changes in the floristic composition and diversity of these forests over time, one of which is the type of management practice. The paper presents the results of research on the floristic composition and diversity of beech forests at two sites in southeastern Serbia (MU "Lomnička Reka" and MU "Bukovik II") over a period of 14 years. The number and cover of all plant species were recorded in the selected sample areas of each locality in 2008 and 2021. The studied beech stands grew in similar environmental conditions – on dystric cambisol and at the altitude ranging from 685 to 735 m. A total of 35 plants were registered at both sites in the period from 2008 to 2021. It was found that the average number of species per plot increased slightly in the research period at both sites. The number and cover of the species that indicate faster decomposition of organic matter and the formation of milder forms of humus such as *Festuca drymeia* Mert. & Koch, *Asperula odorata* L. and *Mercurialis perennis* L. did not change significantly over time. The most significant changes were related to the species that hinder natural regeneration, such as *Rubus hirtus*, whose increased presence was registered after those stands had been thinned, which resulted in the canopy opening.

Keywords: *Beech forests, diversity, vegetation changes, forest management.*

SESSILE OAK (*QUERCUS PETRAEA* (MATT.) LIEBL) VARIABILITY IN THE AREA OF EASTERN SERBIA ACCORDING TO LEAF MORPHOLOGICAL TRAITS

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Abstract

In order to preserve available sessile oak genepool in the area of eastern Serbia and to control usage of genetic resources, intrapopulation and interpopulation research has been conducted on the basis of leaf morphological traits. In July of 2020, 86 trees of phenotypically highest quality and good health condition were selected in three populations, being the carriers of sessile oak (*Quercus petraea* (Matt.) Liebl) reproductive material production, from which undamaged leaves were collected. On the basis of 11 measured morphometric parameters and one derived relation on the sample of 50 leaves per tree, the intrapopulation and interpopulation variability have been determined. The descriptive and multivariate statistic methods were used in the research. Research results indicate high variability of investigated populations. The least variable trait was the length and width relation of a leaf (CV = 13.24%), while the most variable trait was leaf area (CV = 45.39%). Populations were statistically significantly different in all examined leaf morphological traits ($p < 0.01$; $\alpha = 0.05$) according to analysis of variance. Although interpopulation variability was statistically significant, the level of intrapopulation variability was significantly higher (43.6-57.3%) in relation to the interpopulation differentiation (7.2-18.6%). According to obtained results, it can be stated that available sessile oak genepool is characterized by a satisfying level of genetic variability. The obtained results should be accepted as the preliminary ones, which are presenting a good basis for the long-term preservation and ecological adaptability improvement and evolutionary potential of the sessile oak population, by implementing adequate in situ and ex situ conservation measures.

Keywords: *Sessile oak, population, genepool, variability.*

SOIL TYPES IN MANAGEMENT UNIT MATIJEVICA KADIONICA

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Abstract

Management unit Matijeveca Kadionica is in Srem near the Special Reserve Obedsaka Bara, close to the Sava river. The area of the management unit is close to a nature protection area. In this paper we analyzed the soil cover and mapping perspectives in management unit Matijeveca Kadionica, according to the research which has been conducted in 2021. On the determined management unit, the dominant parent material was loess. Textural class of loess is mostly silty clay. According to this dominant parent material in the management unit the most dominant soil types belong to the automorphic soil order and three soil class (humus-accumulative, eluvial – illuvial and cambic soils) toward the classification of Soil of Yugoslavia (1985). Dominant soil type in the management unit belongs to chernozem (83% or 1430,28 ha), luvisol 15.56% and eutric cambisol 1.23%. Morphological structures of chernozem profile A-CG shows the influence of groundwater in soil formation. On the highest part of the management unit, we found eutric cambisol. Cambisol are characterized by the occurrence of a cambic horizon directly beneath the humus horizon. On this soil type it has been determined the occurrence of different oak species including Hungarian oak to. Morphological structures of eutric cambisol profile A-(B) – C. Luvisol characterized by the occurrence bleached E horizon and with morphological structures A-E-B_t-C. This research can be used for the selection of tree species for the restoration in different soil and site type.

Keywords: *Matijeveca Kadionica, chernozem, luvisol, eutric cambisol.*

Acknowledgements. This research was part of project of Ministry of Education, Science and Technological development No. 451-03-68/2022-14/ 200197.

SOIL TYPES IN MANAGEMENT UNIT TOPOLIK

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Abstract

Management unit Topolik is located in a floodplain in the middle Danube part in Serbia. The area of management unit is under nature protection, with different level of protection and all research should consider this in research process. In this paper we analyzed the soil cover and mapping perspectives in management unit Topolik, according to the research which has been conducted in 2021. year. In the research process, it was first determined the dominant process of soil formation on whole area of management unit. It was found that the dominant process in soil formation was fluvial sedimentation. According to this dominant process in the management unit the most dominant soil types belong to the hydromorphic soil class toward the classification of Soil of Yugoslavia (1985). Dominant soil type in management unit belong to fluvisol (83% or 2484,59 ha) and to eugley soil nearly 17% or 486,87 ha. Eugley soil are divided into lower units according to the soil depth (α , β , γ gley). Eugley depths are less than 100 cm. Fluvisol is divided according to textural class into form. The largest area of soil form in management unit Topolik are detected for sandy and loamy form. This research can be used for the selection of the tree species for the afforestation and restauration in different soil and site type.

Key words: *Topolik, fluvisol, eugley*

Acknowledgements. This research was part of project of Ministry of Education, Science and Technological development No. 451-03-68/2022-14/ 200197.

THE CONCEPT OF AGROFORESTRY APPLICABLE IN THE CONDITIONS OF THE SLOVAK REPUBLIC

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Abstract

The term “agroforestry” is understood in a variety of ways. In general, it can be understood as an integration of forestry and agriculture, comprehensive use of land for the needs of agriculture and forestry. The forest is no longer understood only as a source of wood mass, its importance as a provider of comprehensive, so-called ecosystem services is increasingly emphasized. This also requires a change in the concept of forest landscape management. The concept of agroforestry is gradually being domesticated in the conditions of the Slovak Republic. It has become a part of several strategic documents, such as the Envirostrategy 2030, the Strategy of Adaptation of the Slovak Republic to Climate Change, H2VALUE IS WATER, or the National Forestry Program. The aim of the paper is to present the existing solutions applied in the conditions of the Slovak Republic, as well as the potential possibilities of comprehensive land use in the future. As the results of the analysis have shown, a properly applied combination of land use for agriculture and forestry can have not only environmental but also economic benefits for the owner or users of the land. However, it is therefore necessary to secure state support at the legislative and political and economic levels.

Keywords: *forestry, agriculture, agroforestry, land use*

AGROFORESTRY AND PUBLIC PRIVATE PARTNERSHIP: A CASE STUDY OF AGROSILVICULTURE COMMUNITY GROWERS IN MPUMALANGA PROVINCE, SOUTH AFRICA

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Abstract

Agroforestry is a land use system that includes the use of woody perennial and agricultural crops and animals in combination to achieve beneficial ecological and economical interactions for food, fiber and livestock production. Furthermore, public-private partnerships involve collaboration between a government agency and a private-sector company that can be used to finance, build, and operate projects, such as agroforestry/agriculture projects. In this case, a collaboration exists between Mountain to Ocean (MTO) (Private Company) and Agricultural Research Council (ARC) (Government Research Agency) to implement an agroforestry project in Mpumalanga Province, South Africa. The objective of the study was to determine the socio-economic characteristics of the agrosilviculture community growers (ACG) and to link the agrosilviculture community growers (ACG) to the market. A purposive sampling technique was used to select 143 ACG who were spread on the 37.2 ha MTO Forest land, and each allocated a 2601m² area of land for production during October 2021. Quantitative and qualitative designs were used as a questionnaire, stakeholder's discussion and field observations were part of the data collection. The ARC team conducted tele-interviews on ACG before harvest (17 – 20 January 2022) and the second tele interviews on after harvest scenario will be conducted during June/July 2022. The socio-economic data was coded, captured, and analysed using Statistical Package for Social Science. The ACG also emphasized that they went to MTO plantation in search of its good climate including rainfall and as it would improve their livelihood through income generation, job creation and food security. This before harvest scenario was well presented and received by the MTO and potential groundnut market. In addition, the potential market agreed on supporting the ACG with offtake agreements. It is thus recommended that the establishment and expansion of agroforestry should be carried out and intensified in the Mpumalanga Province.

Keywords: *Agrosilviculture Community Growers, Socio Economic, Public Private Partnerships, Mountain to Ocean (MTO), Ehlanzeni District, Mpumalanga Province, and South Africa.*

ECOSYSTEM SERVICES AND EUROPEAN GREEN INFRASTRUCTURE STRATEGY: THE ROLE OF THE URBAN AND PERI-URBAN FORESTS

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Abstract

The European Green Infrastructure Strategy is a “strategically planned network of natural and semi-natural ecosystems with other environmental features designed and managed to offer a wide range of ecosystem services.” On the one hand, a framework that incorporates biodiversity conservation in green infrastructure is being promoted. On the other hand, the interest of researchers, professionals, and decision makers in the structural and functional connectivity of urban and peri-urban forests and in the quality of their environment is also demanded. These forests play a basic role in environmental improvement, as well as in the biodiversity conservation (air pollution removal, carbon storage, erosion control, hydrological regulation, ecological connectivity...). To this end, these “ecosystems” must face a triple challenge: i) a changing environment; ii) a lack of tools to assess environmental perturbations due to its proximity to urban areas; iii) a social perception favourable. This work is based on the knowledge to plan the urban and peri-urban forests in an environment where pressure on them should be regulated. Our aim is to generate a debate analysing their main functions in sustainable development studying a particular case: Green Belt of the Lugo city (Spain). This question is complex because it involves different aspects –social, economic, and environmental–, being necessary a coordination between all stakeholders. Urban and peri-urban forests and open green spaces have an increasingly strategic importance to improve our quality of life. In fact, evidence indicates that the presence of natural assets within an urban context contributes to improving it. In addition to the essential environmental services such as purification of air and water, noise reduction, or stabilization of the microclimate, green areas provide social services crucial to the habitability of our cities and the welfare of its inhabitants.

Keywords: *Green infrastructure, Biodiversity conservation, Stakeholders, Urban world.*

CONSERVATION OF BIODIVERSITY IN URBAN FORESTS AND ITS LANDSCAPE BOUNDARIES

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Abstract

Urban forests and their landscape boundaries have diverse economic, environmental, and social functions from provide to the people with leisure and recreation opportunities, the likelihood of practicing different sports and the well-being that produces enjoy nature near to urban environment to the contribution to energy saving through its microclimatic effect. Also, these forests play a key role in improving green infrastructure for the development sustainable of the cities. Urban forests have to face a multiple challenge: i) a modified and degraded environment, ii) a lack of performances to assess ecological-environmental problems due to their proximity to urban world, and iii) a mostly positive public perception. The knowledge to suitably plan its possibilities should be the basis of the study given the increase in urban pressure on them. Our aim is to generate a logical discussion analysing the role of urban forests like areas of particular significance for biodiversity conservation in the Lugo municipality, Spain. Scientific understanding of how urban forests and green spaces benefit people has grown in recent years to include social, environmental, and economic aspects. However, there is a considerable delay in the political action in a lot of municipalities. Urban forests and their landscape can be regarded as green infrastructure. Research has shown that the benefits of these forests are optimized through a long-term management for maximum efficiency. Awareness about forest resources and land use enables planning for multi-functional use of urban lands to multiply economic returns. For instance, land that is dedicated to other infrastructures, such as power lines, could be managed to grow products for nearby neighbourhoods from fuelwood to food. In Japan, urban green spaces are managed for both recreational use and as areas for disaster relief services if ever needed.

Keywords: *Leisure activities, Social ecosystem services, Cultural landscapes, Rural cities.*

FLORISTIC DIVERSITY IN TWO OLIVE GROVES AND RESERVOIR POTENTIAL FOR NATURAL ENEMIES OF SOME WILD PLANTS

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Abstract

The natural enemies' diversity and abundance are significant in complex landscapes, which are surrounded by flowering non-crop plants. This vegetation may be a potential reservoir that provides alternative hosts or prey for beneficial insects. Floristic diversity in Tunisian olive groves is very important but the fauna present in wild plants is poorly known. In this context, an inventory of the wild vegetation and its harbored arthropods was carried out in two olive groves, located in the region of Sfax. From January, 3rd to June, 6th in 2021, wild plants were weekly sampled (10 plants/species) from fields. Then, plant threshing and examination were completed in the laboratory, in order to collect arthropods from the different plant parts. The results showed 12 plant species belonging to different 9 botanical families, with the dominance of Asteraceae by the following plant species: *Reichardia picroides*, *Senecio gallicus*, *Glebionis coronaria*, *Calendula arvensis*, and *Anacyclus clavatus*. Arthropod sampling showed that *S. gallicus* harbors larvae of lacewings and a large number of aphids and thrips. These insects represent an alternative prey for *Chrysoperla carnea*, which is a predator of the olive moth and the olive psyllid. *G. coronaria* harbors an Anthocoridae species, known as predators of the olive psyllid. *A. clavatus* harbors a *Pnigalio* species, which is known as a parasitoid of the olive fruit fly. In addition, the other wild plants such as *Foeniculum vulgare*, *Retama reatam*, *Convolvulus arvensis*, and *Diplotaxis harra* are hosts of beetles and ants, along with aphids, thrips, and mites, which may be alternative prey for natural enemies of olive pests. The threshing technique of wild flora allowed us to explore some multi-trophic interactions between these plants, olive pests, and their potential natural enemies in olive groves.

Keywords: *wild plants, natural enemies, prey/host, olive groves*

LET ANIMALS BREATHE EASIER IN FIRE

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Abstract

Sivil Düşün is an European Union programme supporting active citizens and civil society organisations throughout Turkey. This study is supported by this programme. Fire Brigade teams make the first response in forest and house fires. Like other disasters, firefighters give priority to human rescue activities in case of fires, and animal rescue activities are overlooked. The target group of this study is the firefighters working in the cities of Aegean region in Turkey. The main activity is to encourage firefighters to use Oxygen masks for animals, unconscious due to smoke or have breathing difficulties in fires. These masks are available in the Fire Brigades in developed countries. In recent years, animal owners have suffered greatly in fires and other disasters in our country. Last year, especially as a result of the forest fires, many large and small animal barns were burned and animals such as cows and sheep perished. In recent years, animal owners have therefore suffered greatly in fires and other disasters in our country. With the widespread use of Oxygen masks in fire, it will make a positive contribution to animal welfare at the regional level. With awareness activities, seminars and events, animal rescue capacity of firefighters will increase. Current study will contribute to animal rescue strategies in case of fire and other emergencies in Turkey.

Keywords: *Sivil Düşün, EU Programme, animal, fire*

ECONOMIC ANALYSIS OF AGROFORESTRY PROJECTS

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Abstract

In agroforestry studies, it was aimed to obtain the maximum amount of product per unit area in the 1950s. In the 1990s, the sociological, ecological and economic features of these practices began to come to the fore. With the developing technology, there has been an increase in the amount/diversity of the product obtained per unit area in agroforestry studies. Thus, the effectiveness of the areas with agroforestry potential and the projects prepared have gained even more importance today. The number of studies aimed at measuring the effectiveness of the prepared projects is few. In these studies, evaluations were made on the combination of agriculture and forestry. In the evaluation of agroforestry projects; linear programming, production boundary analysis, data envelopment analysis, payback period, cost-benefit analysis, internal rate of return and net present value methods are used. In the study, the methods used in the economic analysis of agroforestry projects were examined and compared over the studies in the world and in Turkey.

Keywords: *Economic analysis, Agroforestry, Net present value, Cost-benefit, Turkey.*

RELATIONSHIP BETWEEN AGROFORESTRY AND CLIMATE CHANGE

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Abstract

Climate change is the most important global environmental problem facing all living organisms, including humans, and disrupting natural ecosystems, agriculture and health. In this case, agroforestry emerges as a solid farming practice that addresses the problem of food security by feeding people, mitigates the negative effects of climate change by increasing environmental quality, maintains economic vitality and increases the quality of life. Thus, agroforestry systems incorporate different patterns in different regions around the world that play an enviable role in tackling the adverse effects of climate change by increasing tree crop diversity, which leads to greater carbon storage capacity than growing agricultural crops alone. Agroforestry systems have a higher carbon storage potential than normal forests with component plants. The transition from low biomass land use systems such as grasslands, fallow farmland and scrubland to agroforestry systems provides a net C stock gain by storing CO₂ through C sequestration in biomass. The need to preserve biodiversity in human-dominated agricultural and forest areas is greater today as species are forced to remain in degraded and secondary habitats outside of forest reserves. Agroforestry positively impacts biodiversity by reducing the use of protected areas, increasing biodiversity in a human-dominated or occupied land, and increasing the species and intraspecific diversity of trees in agroforestry systems. In this study, the relationship between agroforestry and climate change has been examined in detail and solutions have been developed.

Keywords: *Climate change, Agroforestry, Carbon emissions, Biodiversity, Turkey.*

DETERMINATION OF THE EFFECT OF DIFFERENT DRYING TEMPERATURES ON THE ESSENTIAL OIL RATIO AND COMPONENTS OF *Lavandula angustifolia*

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Abstract

In this study, the leaves of the harvested *Lavandula angustifolia* plant were dried at different temperatures (25, 35, 45, 55 ve 65 °C). The essential oils of these plants, which were dried at different temperatures, were obtained by water distillation method. The essential oil ratios were determined as 1.17%, 0.96, 0.94, 0.65 and 0.18 at 25, 35, 45, 55 and 65 °C temperatures, respectively. The main components were determined as eucalyptol, and camphor. The highest Eucalyptol ratio was obtained from plants dried at 50.15% and 55 °C, while it was found in lavender leaves dried at 45 and 35 °C, respectively (39.85-39.15%). The lowest eucalyptol ratio was found in plants dried at 65 °C with 17.88%.

Key words: *Essential oil, Gc-Ms, Lavandula angustifolia, Eucalyptol*

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