



BOOK OF ABSTRACTS

*XI International Scientific
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"AGROSYM 2020"
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PREFACE

Dear colleagues,

I am very pleased to introduce the Book of Abstracts of the 11th International Agricultural Symposium “AGROSYM 2020”. Almost 700 contributions were received and around 550 were accepted for oral or poster presentations. Symposium themes cover all branches of agriculture and are divided into six sections: 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 ‘new reality’ created by the COVID-19 pandemic changed many aspects of our lives but confirmed the central role of science, knowledge and innovation in addressing the challenges facing humanity. Therefore, research is of paramount importance to mitigate the impacts of the pandemic on agriculture, food systems and food security. Indeed, on the one hand, COVID-19 has had dramatic impacts on agri-food systems at all scales and in all regions – which might even slow down the achievement of Sustainable Development Goals (SDGs) – and, on the other hand, global agriculture and food systems contribute to the development and spread of zoonoses, such as coronavirus, through their negative impacts on climate, land use and biodiversity. Agricultural production provides food and various other products (e.g. feed, fibre, fuel) but also contributes to numerous environmental, social and economic issues. Agriculture, like any other user of natural resources, has many environmental impacts. Moreover, many agricultural practices carry high costs to both the society and producers, and affect the long-term viability of agriculture. The negative impacts and externalities of agriculture raise questions about the long-term sustainability of high-input, intensive agriculture. One of the goals of the sustainable agriculture movement is to develop farming systems that mitigate or eliminate environmental harms associated with industrial agriculture. Such a shift can bring about benefits in terms of not only the health of ecosystems and the planet, but also that of humans, plants and animals, thus putting into practice the principles of the One Health approach.

The challenge ahead is to develop agriculture and food systems that are more sustainable and resilient to crises, such as the COVID-19 pandemic. In this context, the generation of scientific knowledge and evidence, and its dissemination, through scientific events such as AGROSYM, results fundamental. The results of AGROSYM 2020 should inform evidence-based actions to foster transition towards sustainable, efficient, inclusive and smart agro-food systems. Furthermore, the results reported here will be also significant in the dissemination of knowledge to the wider audience about the importance of agriculture and food science, one of the most important strategic areas of many national research strategies. Finally, they should inform policies in agriculture, food, environment and rural development fields.

Full texts of the submitted communications will be available on the website (<http://agrosym.ues.rs.ba>). Each contribution included in the present Book of Abstracts was positively reviewed by referees.

Many thanks to all the authors, reviewers and colleagues for their help in editing the Book of Abstracts. Special thanks go to all co-organizers, organising partners and sponsors for their unselfish collaboration and comprehensive support that contributed to the success of this virtual edition of AGROSYM.

East Sarajevo, 10th October 2020

Prof. dr Dusan Kovacevic

President of the Scientific Committee of AGROSYM 2020

Editor in Chief



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KEYNOTE PAPERS

COVID-19 PANDEMIC: EXPLORING IMPACTS ON AGRICULTURE, FOOD SYSTEMS AND FOOD SECURITY

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Abstract

In March 2020, the World Health Organization declared COVID-19 (CORonaVirus Disease-2019) a pandemic. As of September 2020, COVID-19 affected all countries, with more than 32 million confirmed cases and about a million deaths. Beyond its health impacts, it triggered an unprecedented global crisis with disorderly, multidimensional impacts. In this context, this paper casts lights on the immediate and long-term impacts of the pandemic on agriculture and food systems worldwide as well as its implications in terms of food security. COVID-19 affected agriculture mainly through confinement measures and feedback loops resulting from changes in international agri-food trade, and domestic food demand and consumption patterns. However, the pandemic effects regard the whole food chain from production through processing and distribution to consumption. Indeed, COVID-19 affected food shopping as well as consumption patterns and diets and even food wastage. Moreover, COVID-19 exacerbated food insecurity and malnutrition, especially among the poor and vulnerable groups. In fact, its impacts regard all the four dimensions of food security (viz. availability, access, utilisation, stability). The pandemic affected food security both directly, leading to a decrease in food production and availability, and indirectly, as containment measures undermined vulnerable people's ability to access nutritious food and, consequently, to have healthy and diverse diets. The pandemic immediate impacts vary from a country to another depending, inter alia, on the epidemiological situation, lockdown and confinement measures, pre-COVID socio-economic development level. It seems that COVID-19 is particularly affecting developing countries and poor and vulnerable groups. The long-term impacts of COVID-19 will depend on the pandemic duration as well as the effectiveness of recovery plans. It is essential to consider agriculture and food systems in the recovery plans to mitigate the pandemic impacts on long-term food security. Moreover, the pandemic should be seized as an opportunity to foster transition towards sustainable food systems that are more resilient to crises.

Keywords: *coronavirus, sustainable food system, sustainable diet, nutrition, food waste.*

HOW COVID-19 COULD REPHRASE AGRICULTURAL EXTENSION AND BRING NEW HOPE TO OLD CHALLENGES: CASE OF THE US COOPERATIVE EXTENSION SERVICES (CES)

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Abstract

The COVID-19 pandemic is an unprecedented world-wide economic and health crisis, with major implications of almost all aspects of life. Food production, agriculture and food supply chains are no exception. Especially the United States are heavily affected by the pandemic, with millions of people unemployed or sick, and more than 200,000 dead. Food producers, processors as well as local and international food supply chains continue to be heavily affected by COVID-19, often unevenly distributed along income and race. Effects reach from farm and processing plant closures over food safety concerns, supply chain disruptions, to labor shortages and consumer behavior. The US Cooperative Extension Services (CES) has the mission to improve the socio-economic situation of communities through the direct translation of university activities and research into the public realm and is as such a form of public service. However, while aiming to enable meaningful change of behavior as a response to problematic situations, the self-understand of CES as public service should not end there. Especially in times of crisis, a functional, flexible and pro-active extension service has been proven to be most impactful. Here we make the case that COVID-19 has shown how united action can lead to a fast national and global response to a threat. We argue that COVID-19 provides an opportunity for extension to re-define its' mission as central role in facilitating, communicating and leadership on other world-wide challenges such as climate change, that have been missing decisive global action.

Keywords: *COVID-19, extension service, effects.*

THE ROLE OF PLANT HEALTH CLINICS IN SAFEGUARDING GLOBAL AGRICULTURE

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Abstract

The United Nations is celebrating 2020 as an International Year of Plant Health with a goal of protecting plants from biotic and abiotic stresses known to reduce crop yields and jeopardizing the world food supply. Among these biotic and abiotic stresses, plant pathogens, insect pests, weeds and parasitic plants along with extremes in temperature, drought and nutritional imbalances significantly affect plant health. Plant pathogens and insects' pests alone account for up to 40% in yield losses worldwide annually. Crop losses may grow exponentially, if growers fail to effectively manage these threatening pathogens and pests as well as abiotic stresses. The first and most crucial key components of a successful management strategy is the accurate and timely diagnosis of these biotic and abiotic stresses. The Plant Health Clinics function at the forefront and provide these vital services to farmers worldwide. These clinics continue to play a crucial role in safeguarding global agriculture by helping farmer and producer communities manage these problems effectively through accurate and timely diagnosis. This presentation will focus on how the Plant Health Clinics in different parts of the world are fulfilling their missions to help farmer communities improve overall plant health.

Keywords: *Plant health clinics, plant protection, pests.*

1. PLANT PRODUCTION

STATE OF BREAD WHEAT AND DURUM WHEAT DIVERSITY IN WESTERN REGIONS OF ALGERIA

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Abstract

The diversity of wheat in Algeria is well known. An inventory has been conducted in the west of Algeria (North and South) to collect local accessions of bread wheat *Triticum aestivum* and durum wheat *Triticum durum* for their morphological characterization. In this context, a collection of 42 traditional accessions and modern varieties of durum wheat and bread wheat was investigated using nine quantitative agro-morphological traits. In the second part of this study (experimental square) the collected seeds were sown in experimental squares in order to set the environmental factor and see its impact on this last. The phenotypic diversity was determined by the Shannon-Weaver diversity index (H') at different levels. The H' showed a wide phenotypic variability for different traits with H' average of 0.56 for bread wheat and 0.61 for durum wheat (inventory), and H' average of 0.61 for bread wheat and 0.58 for durum wheat (experimental square). The results of the multiple correspondence analysis and the hierarchical clustering showed a clear distinction between the different accessions of durum and bread wheat species. The studied accessions partially matched the names of varieties because of the existence of homonyms and synonyms in the names given by farmers. Thus, the present study needs to be confirmed by the molecular tools to best understand the genetic profile of bread and durum wheat in the western Algeria.

Key words: *Algeria, morphological diversity, morphometric traits, durum wheat, bread wheat.*

**GENETIC DIVERSITY ANALYSIS IN CHICKPEA (*CICER ARIETINUM L*)
LANDRACE AND BREEDING LINE GROWN IN ALGERIA USING
MICROSATELLITE MARKERS (SSR)**

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Abstract

The present study aimed to characterize a subset of 10 selected Chickpea accessions (*Cicer arietinum L*) including three Algerian landraces, five breeding line genotypes introduced in Algeria, one Italian landrace and a breeding line from Spain. The ten genotypes were grown in the randomized blocks at the research farms of the department of plant breeding of the International Center for Agricultural Research in the Dry Areas - Morocco ICARDA. The leaves of three to four weeks old seedlings were used for the present study and were considered for the study of genetic diversity, using 20 SSR (Single Sequence Repeat) in which we tried to detect the genetic structure, diversity and allelic variability. While using the twenty SSR, the result indicated a presence of 59 alleles. The genetic diversity varied from 0.32 for TA22 to 0.78 for TA72 and TA117 with an average of 0.66. Polymorphic information content (PIC) values ranged from 0.27 to 0.74. This study also detected a high significant ($P < 0.01$) positive correlation between alleles per locus, gene diversity (H), and polymorphism information content (PIC). In the dendrogram and on the PCoA bi-plots, chickpea genotypes were adjoined according to their geographic origin, suggesting a provenance effect in their ordination, type of chickpea (Kabuli or Desi) and genetic diversity which was also, related to geographical origin. In fact, the most similar accession was that introduced to Algeria (breeding line) which might have common parents in their pedigree. Nevertheless, the distribution of the different grouping through the factorial correspondence analysis (AFC) was due to the genetic variability.

Key words: Chickpea, *Cicer arietinum*, SSR, genetic diversity, Algeria.

INTEGRATED CONTROL OF *TUTA ABSOLUTA* TOMATO LEAFMINER IN MOSTAGANEM PROVINCE (ALGERIA)

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Abstract

Since 2008, the tomato leafminer *Tuta absoluta* (Meyrick, 1917) (Lepidoptera: Gelechiidae) has been considered as a serious threat to greenhouse and field tomato production in the Mediterranean basin and Algeria. This microlepidoptera attacks all the phenological stages of the crop and causes significant damage to leaves, stems and fruits, its damage can reach 100% losses. A number of researches has been carried out to develop control strategies that can help mitigate the extent of this pest on glasshouse tomatoes in the Mostaganem region. Two plants (*Urtica membranacea* Poir.) and (*Mentha spicata* L.) have been used as bioinsecticides for their richness in bioactive substances (aqueous and hydroalcoholic extracts). For extraction, authors used the Soxhlet method. Extraction solvents used is methanol and acetone, the flask contents are concentrated by rotary evaporator. For the larvicidal activity, the concentrations of each extract were tested: at 5, 10, 15 and 20%, then the control treated with distilled water. The mortality rate (%) is determined for each treatment after 24h, 72h, 48h and 7 days after spraying *in vivo* and *in vitro*. The results showed that L2 and L1 larvae are most sensitive to all extracts used. The L3 and L4 are the most resistant instars. The combination of bioactives substances, pheromone traps, black film for mulching, and auxiliaries (with the enhancement of the species of auxiliary insects identified as such under the bioclimatic conditions of the study area), all this has made it possible to biologically control this pest to an interesting degree.

Keyword: *Tuta absoluta*, Tomato, biological control, bioinsecticides.

ANTIOXIDANT ACTIVITY AND PHENOLIC CONTENT OF *ANVILLEA RADIATA*

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Abstract

Current research focuses on the study of naturally occurring antioxidant molecules. This study is part of this perspective and consists primarily of the determination of total phenolic, flavonoids, and condensed tannin contents from the extracts of an endemic plant of Algerian Sahara, *Anvillea radiata*, using four solvents of increasing polarities (hexane, dichloromethane, methanol, and water). Then the antioxidant activity of different extracts was evaluated by the total antioxidant capacity assay, DPPH (2,2-diphenyl-1-picrylhydrazyl) free radical-scavenging ability and ferric reducing antioxidant power (FRAP) assay. The highest extract yield rate was recorded for the methanol extract (20.49 ±0.26 %) followed by the aqueous extract (11.58 ±0.23 %). The quantitative estimation of total phenols, flavonoids and tannin contents by the colorimetric methods showed that the dichloromethane extract was rich in these compounds (114.45 ±0.02 mg GAE/g d.w., 245.21 ±0.07 mg CE/g d.w., and 101.765 ±0.014 mg CE/g d.w respectively) compared to the other extracts. Both the dichloromethane and methanol extracts recorded a significantly high rate in total antioxidant activity (14.41 ±0.009 and 9.55 ±0.0023 mg GAE/g d.w. respectively) and exhibited a significant ability to quench DPPH radical (IC50% value = 0.9 ±0.026 and 1.75 ±0.051 mg/ml respectively) and a significant iron reducing power (EC50% = 0.98 ±0.034 and 1.31 ±0.043 mg/ml respectively) compared to the other extracts, but remain significantly lower than that of ascorbic acid (EC50% = 0.005 ±0.003 mg/ml). The results of the present investigation clearly indicate that the dichloromethane and methanol extracts of *Anvillea radiata* exhibit an important antioxidant activity *in-vitro*.

Keywords: *Anvillea radiata*, Algerian endemic plant, Phenolic content, Antioxidant activity.

BIOCHEMICAL ANALYSIS OF CELL WALLS POLYSACCHARIDES OF PHOENIX DACTYLIFERA INFLORESCENCES

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Abstract

This work concerns biochemical analysis of the cell walls polysaccharides of *Phoenix dactylifera* inflorescence. Indeed, this species has been insufficiently biochemically studied. Samples have been cut into pieces (1cm) and weighed to determine their fresh weight (FW) and put to dry at a temperature of 60 ° C for a night. They have been reweighed until a constant final (WD). $TE\% = [(WF-WD) / WD] \times 10$. The samples have been ground into a powder to obtain residue and 5 g of residue have been treated with 4% NaOH with stirring overnight. The filtrate has been neutralized by acetic acid and it constitutes the Hemicelluloses 1. This operation has been repeated to obtain hemicellulose 2 and 3. Residue constitutes cellulose. Filtrates have been precipitated in ethanol, Centrifuged 3600 rpm 30 minutes. Highly methylated pectin's (PHM) have been extracted with boiling water, while weakly methylated pectins (PWM) have been extracted with EDTA. The residue obtained has been treated with 1% EDTA pH 6.5 adjusted with NaOH solution, stirred six hours. After filtration, the solution obtained has been dialyzed against running water, the dialysate has been concentrated, and the weakly methylated pectin's have been precipitated in cold acetone (1V-2V). After centrifugation, the pellet obtained has been washed, and then dried. It constitutes the pectin fraction. 100 mg (Hemicelluloses or Pectin) and 10 mg cellulose have been mixed in 2 mL of 1N H₂SO₄, at 100°C for 4 hours. Or 72% H₂SO₄ at the temperature for 2 h and then 9 mL at 100°C for 2h. Filtrate has been neutralized by Strontium Carbonate which will be used for chromatographic analysis. TLC is used to determine the osidic composition of polysaccharide fractions. The control sugars are prepared at a concentration of 0.025 g / mL. D-Glucose, D-Mannose, D-Arabinose, D-Xylose, D-Galactose, L-Rhamnose, L-Fructose. Randerath migration and revelation solvent. Water content 32.71g ; Water content 32.71g ; Weight determination 27g or 69.95%. Weight determination 27g or 69.95%. Amounts of cellulose 3.07g (61.4 %). Hemicelluloses 0.19 g. Pectin's (PHM) 0.1 g. PMF0.01 Chromatographic analysis Cellulose is composed of glucose, hemicellulose is formed from xylose. PHM is constituted of xylose and arabinose. PFM made up of arabinose. The results are compared and discussed with our works on other species.

Keywords: *Phoenix dactylifera*, biochemical analysis, polysaccharides, inflorescence.

VALORISATION AND SAFEGUARDING OF THE OLIVE INDUSTRY IN ALGERIA

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Abstract

Fruit arboriculture and particularly olive growing is very diverse in Algeria. It is made up of species, rustic and characteristic of the Mediterranean region. Certainly, all countries are dependent to a large extent on plant genetic resources from elsewhere, and our country is no exception to the rule, but we must not forget that our flora contains untapped resources, and this reservoir of local genes must be preserved and valued. Safeguarding the local genetic heritage is a universal concern. Local genetic resources are an important economic issue in state policy. They are currently a decisive weapon for the maintenance of national sovereignty. The development, valorisation, enhancement and use of genetic resources in olive cultivation is among the objectives of the Ministry of Agriculture. A project was carried out, within the framework of an Algeria convention with the IOC (International Olive Council), relating to the “Conservation, characterization, collection and use of genetic resources of the olive tree”. The objective of this project is to increase the availability of indigenous olive genotypes by propagating and supplying farmers with high quality, better yielding olive plants, good phytosanitary status (free from pests/resistant) and optimally adapted to the specific characteristics of the climate and the soil. This objective is dependent on the modernization of the nursery sector with a direct impact on the expansion of the olive industry and the introduction of new technologies and innovations in the olive sector.

Keywords: *olive resources, valorisation, safeguarding, Algeria.*

DURUM WHEAT PHENOLOGY RESPONSE TO CLIMATE CHANGE IN ALGERIA

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Abstract

IPCC reports indicate that North African agriculture is likely to be among the most affected in future climatic conditions, due to its high dependence on low income from rain-fed agriculture, but above all due to its low capacity adaptation. This paper has two objectives: to estimate the impact of climate change on the phenology of durum wheat in Algeria, and to highlight the choice of the sowing date as an adaptation strategy. A simple agro-meteorological model is used to simulate the cultivation of durum wheat on a daily basis. Among the multiple outputs of the model, we are particularly interested here in phenological evolution, which calculation is based on thermal time. Two sowing options are tested: a dynamic date and a prescribed date. The future phenological crop behaviour is obtained through the model using climate projections from Météo France ARPEGE Climate model under the medium A1B SRES scenario for the distant future (2071-2100). The increase in temperatures in the future climate induces a shortening of the crop cycle. This depends on the future climatic characteristics of the region, but also on the chosen sowing strategy. The vegetative phase is particularly shortened especially in dynamic sowing (47 against 27 days on average in the prescribed sowing). The reproductive phase undergoes an elongation in the case of dynamic sowing, and does not vary significantly in the prescribed sowing. The displacement of the cycle and its shortening influence negatively the accumulation of total dry matter (CT) and yields in the future climate.

Key words: *Algeria, climate change effects, durum wheat phenology, crop modelization, sowing options.*

IDENTIFICATION AND CHARACTERIZATION OF THE CAPER (*CAPPARIS SPINOSA* L.) IN ALGERIA

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Abstract

In Algeria the caper is unknown, underestimated and not much studied. This xerophytic, perennial shrub is on the rise and in full evolution both in its geographic distribution and in its use, as this shrub has exceeded the Mediterranean basin, and its importance is being recognized in the whole world. It is cultivated in many countries for economic values (mainly flower buds consumption), for its medicinal and pharmacological properties, and ecological values considering the remarkable botanical characteristics. It is considered to be a useful shrub in beekeeping and it is used against erosion due to the importance of its root system, which emphasize the fact that it could be a great approach to a new agriculture system well adapted to climatic changes, global warming and future challenging environmental conditions, since it has an amazing ability to adapt to harsh environments too. Where the access to the desert is prohibited for many Mediterranean species, this one can be found in both. However, due to its very wide heterogeneity and the lack of genetic studies, the identification and classification of the caper has always been very difficult. The present study treats an investigation into its use and its location in Algeria and to collect local accessions. Also, in this context biometric parameters are measured for identification and classification of the variations present in Algeria. The study was made using image J software on different quantitative and qualitative parameters, since *Capparis spinosa* shows considerable morphological variation. The data are exploited through the use of bioinformatics software.

Keywords: *Capparis spinosa*, traditional use, identification, Algeria.

THE STUDY OF PHYSIOLOGICAL PARAMETERS OF INTRODUCED WHEAT GENOTYPES

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Abstract

Wheat is one of the most important cereal crops in human nutrition. Demand for wheat by 2050 is predicted to increase by 50 percent from today's level. However, global warming, the spread of fungal diseases especially, have a negative effects on wheat production throughout the world. By harnessing the latest technologies in crop physiology, genetics and breeding, new varieties are being developed that are more resilient to climate change and diseases. The Research Institute of Crop Husbandry has a close relationship with international breeding centers, such as CIMMYT, ICARDA for wheat improvement since the mid 90s of the last century. We aimed to study some physiological traits of introduced wheat genotypes. 110 genotypes of bread wheat nurseries 20th IWWYT-SA, 21th IWWYT-IR, 25th FAWWON-SA, 25th FAWWON-IR, CWANA 18th DSBWON, CWANA 18th DSBWYT, CWANA 18th SBWYT-HT, CWANA 18th ESBWYT, CWANA 18th SBWON-HT and durum wheat nurseries 41th IDYT, 41th IDON were grown in 5m² plots under irrigated conditions. The study was conducted during 2018-19 growing season. We investigated above ground dry mass dynamics from tillering growth stage till physiological maturity, photosynthetic pigments content, net photosynthesis productivity, relative water content, grain yield and yield components of wheat genotypes. The highest increase in dry mass from the end of tillering to the beginning of grain maturation was observed in nurseries 20th IWWYT-SA, 21th IWWYT-IR, and 25th FAWWON-IR. The highest indicators of above ground dry biomass were found in spring bread wheat nurseries CWANA 18th SBWYT-HT, CWANA 18th ESBWYT and spring durum wheat nurseries 41th IDYT, and 41th IDON. The relative water content in the flag leaf was higher in bread wheat nurseries 20th IWWYT-SA, 21th IWWYT-IR, 25th FAWWON-SA, 25th FAWWON-IR and durum wheat nurseries 41th IDYT, and 41th IDON. The content of Chl a, b, carotenoids was on average higher in nurseries 20th IWWYT-SA, 25th FAWWON-SA, 21th IWWYT-IR, 25th FAWWON-IR, and 41th IDON, while it was lower in nurseries CWANA 18th DSBW-ON, CWANA 18th ESBWYT, CWANA 18th SBWON-HT. Average grain yield (g\m²) was higher in nurseries of bread wheat CWANA 18th DSBW-ON, CWANA 18th SBWYT-HT, CWANA 18th ESBWYT, CWANA 18th SBWON-HT, and 20th IWWYT-SA and in durum wheat nurserie 41thIDYT, with a relatively long grain filling period.

Keywords: *wheat, nurseries, above ground dry mass, relative water content, grain yield.*

THE STUDY OF GRAIN YIELD AND YIELD COMPONENTS OF WINTER BREAD WHEAT UNDER NONSUPPORTED WITHMOISTURE CONDITION

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Abstract

Grain yield and yield components of 21 genotypes of winter bread wheat were studied under nonsupported with moisture rainfed conditions of the Mountain Shirvan. The average grain yield in the conditions of rainfed, drought, and irrigation in 2013 amounted to 685, 656, 728 g/m², respectively compared to 2014 amounted to 447, 336 and 515 g/m², respectively. From an average value of two years, high grain yield in the rainfed condition was found in genotypes Gobustan, Tale 38, 7th WON-SA №465 and 12th İWWYT №6, in the drought condition in genotypes Gobustan, Gyrgyzgul 1, 7th WON-SA №465 and Ferrigineum 2/19, in the irrigation condition in genotypes Tale 38, Gyrgyzgul 1, Gobustan, 7th WON-SA №465 and Ferrigineum 2/19. On average, drought led to a decrease in grain yield by 20.7 % compared with irrigation. The largest yield loss was detected in genotypes Tale-38 by 29.3%, Gyrgyzgul 1 by 27.2%, 12th İWWYT № 8 by 23.1%. The lowest yield loss was found in genotypes Shaki 1 by 15%, Murov 2 by 15.5%, and in genotypes 7th WON-SA №465 and 11th İWWYT №20 by 16.6%, respectively. By an average value of 2013 and 2014 years, the aboveground dry mass was 1765 g under rainfed, 1556 g under drought, and 1854 g under irrigation conditions, respectively. The number of spikes per 1 m² decreased by 7.8 % in the condition of drought compared with irrigation. The lowest decrease in the number of spikes per 1 m² was found in the genotypes Bezostaya 1 by 4.2%, Aran by 4.6%, and Sheki 1 by 4.7%. In 2013, in both conditions of drought and irrigation, a correlation relationship of $r=0.75^{**}$ was revealed between grain yield and number of spikes per 1 m, whereas in 2014, the correlation between grain yield and number of spikes in 1m² in the condition of drought was $r = 0.55^{**}$, in the condition of irrigation was $r=0,53^*$.

Keywords: *wheat, rainfed, drought, irrigation, genotype, grain yield, yield components.*

**THE EFFECT OF THE VOLATILE ORGANIC COMPOUNDS PRODUCED BY
SERENDIPITA INDICA ON THE GERMINATION AND SEEDLING GROWTH OF
SALT STRESSED *OCIMUM BASILICUM* SEEDS**

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Abstract

Serendipita indica (SI) is a growth promoting root endophyte. In this paper authors investigated the effect of its volatile organic compounds on the germination of salt stressed *Ocimum basilicum* 'Fin Vert' seeds. They were sown in one half of split petriplates, filled with Murashige and Skoog medium supplemented with 30g of sucrose, 7g and of agar and 5 salt stress levels (0, 1, 3, 6, and 9g/l NaCl). The other half contained Potato Dextrose Agar and was either inoculated or not inoculated with SI. The beneficial effects of SI VOCs on germination and seedling growth, even on 9 g/l NaCl were demonstrated.

Keywords: *Serendipita indica* (SI), *Volatiles organics compounds* (VOCs), *Basil* (*Ocimum basilicum* L.), *Salt stress* (NaCl), *Germination*.

INFLUENCE OF CLIMATIC FACTORS ON PEPPER PRODUCTION BY DIRECT SOWING

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Abstract

Pepper has increased requirements for growing conditions, and during the vegetation it is especially sensitive to lack of water, the appearance of low or high temperatures and increased relative humidity. The paper presents the values obtained by monitoring and measuring these three climatic factors. The aim of this research was to determine the magnitude of the influence of climatic factors on the possibility of pepper production by direct sowing on the basis of the analysis of long - term data. Temperature values, precipitation amount and distribution, and relative humidity values were monitored over a four-year period to determine the influence of climatic factors on the possibility of pepper production by direct sowing. The analyzed climatic factors are presented through: average monthly temperatures, average daily temperatures, amount and distribution of precipitation, as well as relative humidity. Climatic factors have a high impact on the success of production, which is why it is necessary to design and introduce new agro-technical measures, and the old agro-technical measures need to be adapted and harmonized with the climatic conditions and requirements of pepper. Proper and accurate determination of sowing time is the basis of successful pepper production. In the production of peppers by direct sowing, the same attention should be given to the choice of pepper type as when determining the time of sowing.

Key words: *pepper, direct sowing, yield, climatic factors.*

IMPORTANCE OF WHEAT FOR VEGETABLE PRODUCTION

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Abstract

The quality and fertility of the soil can be preserved with strict respect for crop rotation, by plowing the crop residues by regularly adding manure. Intensive vegetable production leads to a decrease in the content of organic matter, and thus to a decrease in the quality and fertility of the soil. The constant reduction of livestock leads to irregular and insufficient intake of organic fertilizer, which is why harvest residues are gaining in importance as a valuable source of organic matter. Determining the exact mass of harvest residues - straw that remains after wheat harvest was carried out on an area of 750 ha with four varieties of wheat. The paper presents the results of measuring the remaining straw on stubble with a cut height of 15 cm. It is important to point out that after the harvest, the root system of the plants and the above-ground part remain in the soil up to the cut length, which makes a significant additional organic matter that should not be neglected. The aim of this paper is to consider the influence of wheat, as a pre-crop for vegetable crops, on the amount of crop residues that will contribute to the increase of organic matter after plowing, ie. soil fertility, and thus yield as well as the quality of cultivated crops. Plowing of crop residues must be introduced as a mandatory agro-technical measure, which would completely eliminate the incineration or removal of crop residues.

Keywords: *crop residues, straw, wheat, organic matter, fertility, vegetables, yield.*

THE INFLUENCE OF NITROGEN ON THE YIELD AND QUALITY OF CARROTS

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Abstract

Carrots belong to nitrophilic plants. It deposits nitrogen in the roots and leaves. In carrot production technology, the proper use of mineral fertilizer is very important. Improper nitrogen fertilization causes nitrate to accumulate at the root of the carrot. The aim of the study was to show how increasing doses of nitrogen affect the quality and yield of carrots. Doses of nitrogen were analyzed 2016 (ø, 80 kg N/ha, 160 kg N/ha, 240 kg N/ha) and following arieties were tested (*Almaro F1*, *Chantenay*, *Flakkee*). The obtained results were processed by the variance analysis method for a two-factor experiment (ANOVA). The significance of differences between individual environments was tested by LSD test. The results of the experiment show that increasing doses of nitrogen have a negative effect on the quality of carrots. The highest accumulated nitrogen (0,059%) was in the variant 240 kg N/ha. The least accumulated nitrogen was in the control variant (0,050%). the potassium content, depending on the fertilizer, was moving in the direction of falling. A nitrogen dose of 80kg/ha did not significantly affect yield.

Keywords: *carrots, nitrogen fertilization, yield, quality.*

PHENOLOGICAL CHARACTERISTICS OF SWEET CHERRIES ON TWO DIFFERENT TYPES OF EUTRIC CAMBISOL IN HERZEGOVINA REGION (BOSNIA AND HERZEGOVINA)

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Abstract

The aim of this study was to determine the influence of different soil types of eutric cambisol on flowering and ripening of sweet cherry (*Prunus avium*) cultivars (Burlat, Skeena and Sweet heart). The research was conducted on the micro-locality Vrapčići, north of Mostar city (Bosnia and Herzegovina) in 2018 and 2019. The influence of the year on the beginning and duration of the flowering phenophase was evident, and the earlier beginning and shorter duration of flowering in all cultivars was recorded in 2019. Soil type had a statistically significant impact on the beginning of flowering, so the earliest beginning of flowering was recorded on soil variety I, in the cultivar Burlat in 2019, and the latest in the cultivar Skeena on the type II soil in 2018. The cultivars Burlat and Sweet heart had the shortest flowering in 2019, and in 2018 Burlat flowered the longest on soil type I and Sweet heart on soil type II. Ripening took place at the same time on both soil types. The earliest beginning of ripening was in the cultivar Burlat in 2019, and the latest in the Sweet heart cultivar in 2018. The shortest ripening duration was recorded in the Sweet heart cultivar, while the longest ripening duration in the Burlat cultivar in both observed years. It can be concluded that the soil types I and II significantly influenced the beginning of flowering of all three cultivars of sweet cherry (Burlat, Skeena and Sweet heart) in both study years, while the type of soil has had no impact on the stages of ripening phenophase.

Keywords: *soil type, sweet cherry, flowering, ripening.*

ANALYSIS OF VEGETABLE PROTEINS BY CAPILLARY GEL ELECTROPHORESIS (CGE)

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Abstract

Protein content in plant species varies depending on the species and stage of maturity. In plants, proteins represent a structural material and show characteristic activity and function. Therefore, proteins are carriers of basic life functions in the cell. Different techniques can be used to separate and identify proteins. The aim of this study was to examine the possibilities of applying SDS-capillary gel electrophoresis (SDS-CGE) for separation and quantitative analysis of vegetable proteins. Potato and carrot samples were used as test samples. Extraction of total proteins was performed, and separation of proteins from vegetables was carried out by capillary gel electrophoresis (CGE), using the SDS-MW Analysis Kit (Beckman Coulter). During protein analysis by capillary gel electrophoresis, a mixture of 7 proteins of known molecular weights (10 kDa, 20 kDa, 35 kDa, 50 kDa, 100 kDa, 150 kDa and 225 kDa) was used as the Mw standard. On the electrophoregram, obtained after the analysis of potato proteins, 31 proteins of different molecular weights were separated. After the analysis of carrot proteins, 21 proteins of different molecular weights were separated. Proteins with molecular weights of 50-100 kDa had the highest relative protein concentrations, in the amount of 44.94% in potato and 53.03% in carrot. This method enables the identification and quantification of vegetable proteins and it can be used to study the changes and behavior of proteins in different growing and processing conditions of vegetables.

Keywords: *Proteins, Vegetables, Capillary Gel Electrophoresis.*

INFLUENCE OF COAGULATION CONDITIONS ON THE CONTENT OF FATTY ACIDS IN ACID-COAGULATED CHEESES

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Abstract

Cheese is a product formed by the separation of whey after coagulation of milk. Milk coagulation can be done in several ways. Acid-coagulated cheese is produced by the action of high temperatures with the addition of organic acids. The aim of this study was to examine the influence of coagulation temperature and coagulant type on the content of saturated and unsaturated fatty acids in cheese, obtained by heat-acid coagulation of milk. Protein coagulation was performed at a temperature of 85°C (samples 1, 3, 5) and 95°C (samples 2, 4, 6), and three organic acids were used as coagulants, namely: citric acid (samples 1 and 2), tartaric acid (samples 3 and 4) and acetic acid (samples 5 and 6). Determination of the qualitative and quantitative composition of fatty acids in the tested samples was performed by GC analytical technique. Palmitic (C16:0), stearic (C18:0) and myristic (C14:0) acids were the most abundant of the saturated fatty acids in the tested cheese, and oleic acids (C18:1) of the unsaturated fatty acids. The palmitic acid content ranged from 30.61% (sample 3) to 31.00% (sample 5) of the total amount of identified fatty acids. The stearic acid content ranged from 11.57% (sample 3) to 11.79% (sample 5), while the myristic acid content ranged from 10.89% (sample 3) to 10.98% (samples 5 and 6) of the total fatty acids identified. The oleic acid content ranged from 24.05% (sample 3) to 24.40% (sample 6) of the total amount of identified fatty acids. Other identified fatty acids were present in smaller amounts in the tested samples.

Keywords: *Milk, Cheese, Fatty Acids.*

THE EFFECT OF FERTILISATION ON THE PHENOLOGICAL CHARACTERISTICS OF SELECTED APPLE VARIETIES IN SARAJEVO CONDITIONS (BOSNIA AND HERZEGOVINA)

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Abstract

This research has studied the effect of fertilization on the variability of blossom time of different apple varieties in the geographical region of Sarajevo (Bosnia and Herzegovina) in 2020. For sustainable fertility it is necessary to recognize the phenophases of development of different apple varieties and, on that basis, to ensure norms of fertiliser, when and in which manner has to be applied. The research focused on three apple varieties: 'Jonagold_Dacoste', 'Red Idared' and 'Gala Shniga'. Fertilization models applied included the following fertilization treatments: control (no fertilization), standard conventional fertilization (300kg/ha NPK 6-18-36 + 150kg/ha KAN), foliar fertilization (Firofert Crystal 10-40-10+1MgO+ME and Fitofert Crystal 20-20-20+ME with an addition of sucrose solution in the values of 10, 15 and 20%). The goal of the research was to determine the effect of different models and versions of fertilization on the blossom phenophase of the selected apple varieties in the area of Sarajevo, in order to supplement the deficiencies in fertilization arising in the time of fruiting. The results of the research show that different applications of fertilization have a varying effect on the variability of time and scope of blossoming of the selected apple varieties. The most significant average volume of blossoming has been registered for the apple variety 'Red Idared' (grade scale 0-5, grade 5), and the least significant for the apple variety Jonagold_Dacoste (grade scale 0-5, grade 2).

Key words: *apple varieties, phenological observations, fertilisation, pollen germination.*

MORPHOLOGICAL CHARACTERISTICS OF AUTOCHTHONOUS GENOTYPES OF SWEET CHERRY (*PRUNUS AVIUM* L.) CV. 'ALICA' AND 'HRUST' IN AREA OF HERZEGOVINA

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Abstract

The paper presents the results of a two-year study of morphological characteristics of autochthonous sweet cherry (*Prunus avium* L.) varieties 'Alica' and 'Hrust' within the period 2018-2019 in Herzegovina region in Bosnia and Herzegovina. This study included monitoring of quantitative pomological characteristics such as fruit weight, width, length and thickness, stone weight fruit skin weight, fruit stem length leaf length and width, leaf stalk length, fruit shape index, as well as flesh percentage. On the basis of evaluated data, the best fruit performance was registered at some varieties of sweet cherry grown in a condition of this part of Herzegovina. The highest average of fruit weight (8.72 g), fruit width (25.18 mm) and fruit length (22.36 mm) was found in a variety of 'Hrust DH1'. As for fruit thickness, variety 'Hrust GH4' had the highest value (21.35 mm). The 'Alica' species showed lower values of the analyzed parameters, which could be related to the varietal characteristic because it belonged to the varieties with smaller fruit. The highest fruit weight, length, width, and thickness was shown by 'Alica JA2' (6.32 g, 21.05 mm, 22.94 mm and 19.45 mm, respectively). Principal Component Analysis (PCA) shows reliability for separation of all analyzed autochthonous 'Alica' and 'Hrust' cherry genotypes based on morphological characteristics. The analysis of the obtained results shows that the total variance of the research is within the dominant eigenvectors in the first main component (PCA), which accounted for 40.795% of the research. The most significant properties of the first component relate to the morphometric properties of the cherry fruit. Within the second main component, which accounts for 56.968% of the total variability of the experiment, most of the properties with a high value for the eigenvector are related to the morphological characteristics of the leaves. Based on the research results, it may be concluded that this, once very respectable variety, over the years has acquired adaptability to climate conditions and that it should be further investigated as a valuable genetic potential.

Keywords: *autochthonous, genotypes, Alica, Hrust, sweet cherry.*

CHEMICAL COMPOSITION AND ANTIOXIDANT ACTIVITY OF FRUITS OF THREE PLUM CULTIVARS GRAFTED ON FOUR ROOTSTOCKS

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Abstract

Chemical and antioxidant properties of fruits of three plum cultivars ('Čacanska Rana', 'Čacanska Lepotica' and 'Čacanska Najbolja') grafted on four rootstocks (Myrobalan, 'Pixy', 'Fereley' and 'St. Julien A') were studied in the region of Belgrade (Serbia). Chemical composition of plum fruits was found to be more cultivar- than rootstock-dependent. The average values for soluble solids, total sugars, inverted sugars, sucrose, and total acids content in cultivar/rootstocks combinations ranged from 11.7 to 14.2%, from 9.5 to 11.5%, from 6.6 to 7.6%, from 2.7 to 3.9%, and from 0.71 to 1.11%, respectively. The contents of soluble solids and total sugars were the highest in fruits of 'Čacanska Najbolja', while the lowest contents were found in fruits of 'Čacanska Rana' cultivar. Total phenolic content (TPC) in the skin and flesh of plums was in the range from 4.44 to 15.93 mg GAE g⁻¹, and from 0.38 to 0.86 mg GAE g⁻¹ respectively. TPC in the skin was 6–20 times higher than in the flesh of the same cultivar/rootstock combinations. Differences in TPC among rootstocks were not statistically significant, but significant differences among cultivars were found. Radical-scavenging activity (RSA) in the skin and flesh ranged from 39.08 to 78.49 μmol TE g⁻¹, and from 10.40 to 16.97 μmol TE g⁻¹ respectively. Significant differences in RSA were found among cultivars and cultivar/rootstock combinations, whereas differences between rootstocks were not significant. The highest RSA was found in fruits of 'Čacanska Najbolja' cultivar.

Keywords: *Prunus domestica*, cultivar/rootstock combinations, total phenolic content, radical-scavenging activity.

COLLECTING WILD PEAR IN EX SITU CONDITIONS IN ORDER TO PRESERVE DIVERSITY

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Abstract

Wild pear population in the Banja Luka region in *in situ* conditions is characterized by great diversity. Preservation of diversity and collection is possible through cultivation in *ex situ* conditions. The research material was 54 wild pear seedlings, produced in 2009, and created by free propagation of 9 genotypes from the *in situ* population. The seedlings were located in the collection at production area of Agricultural Institute of Republic of Srpska, Banja Luka (Bosnia and Herzegovina). Morphological characterization of seedling vegetative organs was done in accordance with the international UPOV descriptor. Seedlings were of different lushness depending on the genotype, and they were mostly of medium lushness. The exception was seedlings of genotype 25 from Manjača area, which were all very lush and of upright growth type. The colors of the bark of one-year-old shoots were different shades of brown, and 6 seedlings derived from genotype 31 had a purple color of the bark. The leaves were very heterogeneous in terms of the qualitative characteristics of the leaves. The seedlings began to bear fruit in different years of development. By the end of 2019, 23 fruit trees were fruit bearing. The earliest fruit bearing seedlings began to bear fruit as five-year-old trees. Most seedlings had a round to flattened fruit shape, and only 3 had an elongated fruit shape. According to the size of the fruit, seedling 93 stand out with the fruit weight of 37.99 g. With a larger number of seeds (> 8), seedlings are an important material in the selection of generative rootstocks.

Keywords: *Wild pear, diversity, seedling, fruit.*

GRAIN FILLING PERIOD OF WINTER BARLEY

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Abstract

Each yield component of barley is determined by developmental events during specific phenological phases. The number of spikes per unit area is established from tillering to jointing. Spikes continue to develop between single ridge and flag leaf elongation and the number of kernels per spike is established from jointing, i.e., it starts from double-ridge of apical meristem development and sets shortly after anthesis. Duration and rate of grain filling determines kernel weight. The objectives of this study were to examine the variation and relationships among phenology and yield components. Twenty-four winter barley cultivars were used in this investigation. The stage of leaf development of the main culm was referenced to the Haun scale. The relationship between kernel weight and growing degree days (GDD) accumulated from anthesis for each plot was determined by fitting the quadratic polynomial. The duration from planting to flag leaf was 1223 GDD across two-rowed varieties and 1304 GDD across six-rowed varieties. The variety NS 519 had the shortest grain fill period (648 GDD), the variety Marinka the longest (940 GDD). GF rate was mainly determined by genotype (44.3% of total variation) and GxY interaction (31.1% of total variation). GF rate across two-rowed varieties was rather higher (7.251 mg 100 GDD⁻¹) than across six-rowed varieties (6.395 mg 100 GDD⁻¹). Our results show that the pre-heading period varied more than the grain filling period in the tested varieties. Selection for shorter vegetative period and longer grain filling period is recommended in the development of varieties for semiarid conditions of growing.

Keywords: *Winter barley (Hordeum vulgare L.), phenology, vegetative period, grain filling, yield components.*

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CLIMATE CHANGES AND WATER SAVING STRATEGIES FOR IMPROVING PRODUCTIVITY AND QUALITY OF AGRICULTURAL CROPS

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Abstract

Drought and lack of water are one of the major limiting factors in intensive agricultural production. The plant world is extremely sensitive to water deficiency, which directly affects the growth of plant cells. The growth of leaves is especially sensitive to lack of water, and their surface is significantly reduced in drought conditions. In addition to the above, in drought conditions, there are changes in the size and number of stomata, which vary among plant species and depend on the severity of the water deficit. Today, the world's population is struggling with climate change and drought and is accessing modern irrigation methods. New methods of reduced irrigation (regulated irrigation deficit - RDI and partial root drying - PRD) have shown that the amount of irrigation water can be reduced without having a significant impact on the quantity and quality of crop yields. The difference between the methods is that in the RDI process, the entire root system of the plants is watered with a reduced amount of water, while in the PRD process alternate watering and drying of part of the root system is performed. Both methods of reduced irrigation are based on knowledge of the physiological reactions of plants to lack of water. Today, modern technology plays an important role in the irrigation process, and a number of automated support systems are available on the market. They integrate the results of scientific achievements from agriculture and technological innovations and help in the decision-making process during irrigation.

Keywords: *climate changes, water saving strategies, regulated irrigation deficit, partial root drying, drought.*

THE EFFECT OF WATER EXTRACT OF ALOE VERA (L.) BURM. F. ON GERMINATION AND GROWTH OF SCARLET SAGE

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Abstract

The aim of research was to determine effect of water extracts of plant species *Aloe vera* (L.) Burm.f. on the seed germination, germination energy and growth of scarlet sage seedlings-*Salvia splendens* L. The seed that has better germination energy also has better vigor, so it is more resistant to stressful conditions during germination. *Aloe vera* is an important medicinal plant from the Liliaceae family. It is a succulent herb which grows world wide. Its large leaves contains liquid of yellow latex and clear gel, which is rich in essential amino acids, mono- and polysaccharides, lignin, macronutrients, micronutrients, vitamins, gibberellins and salicylic acid. Aloe leaf extract has been used to improve the vegetative growth of many horticulture plants. Aloe extract contains plant hormones such as gibberellin, and can be used as a source of hormone instead of synthetic growth regulators. The experiment was conducted in laboratory condition at the Faculty of Agriculture, University of Banja Luka and consisted of control (distilled water) and treatment with water extract of Aloe. Water extracts were prepared from fresh leaves and experiments were conducted in Petri dishes at the 5, 10, 15, 20%. Temperature in the laboratory was constant at 20°C and light regime was set to 16h day/8h night. Water extracts of Aloe at a concentration of 20% had positive effect on the seed germination and germination energy, while concentration of 10% had positive effect on shoot and root length, and fresh and dry mass of scarlet sage seedlings.

Key words: scarlet sage, *Aloe vera* (L.) Burm. f., water extracts.

THE INFLUENCE OF TEMPERATURE AND SOIL TYPE ON GERMINATION SEED WHEAT

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Abstract

In order to achieve high wheat yields, it is necessary to determine the optimal plant composition, which is achieved through the use of quality seeds. Seed quality is affected by germination, purity and absolute seed mass. Seed germination is a variable trait. Seed germination is determined by standard methods under optimal laboratory conditions. Seed germination by standard methods is not real germination, because under natural conditions and under the influence of external factors and hereditary and non-hereditary seed properties, germination is much smaller. Seed germination and development of wheat under natural conditions takes place at much lower temperatures and in the presence of pathogenic soil microorganisms. For this reason, laboratory tests were carried out to determine the germination of seeds of two wheat varieties. The experiments were set on soil taken from two localities (East Sarajevo and Bijeljina). In addition to the standard seed germination method, we also took a test at temperatures of 2°C, 8°C and 12°C, respectively, at temperatures that are characteristic for our winter wheat production areas, for the period from October to December. After 10 days of seed germination in the growth chambers, the temperature was increased to 25°C and seed germination was observed for the next 6 days. The Russian variety had a higher percentage of seed germination compared to the domestic variety. Wheat seed sown in the soil of the humofluvisol type (Bijeljina) had higher germination compared to the seed sown in the soil of the alluvial type (East Sarajevo). The lowest germination had the seeds germinated at 2°C for 10 days, and then at 25°C for 10 days, and the biggest germination had the seed germinated at 12°C for 10 days, and then at 25°C.

Keywords: *Wheat, variety, germination, soil, temperatures.*

INFLUENCE OF SUPERADSORBENT "TVERDAYA VODA" ON YIELD AND QUALITY OF POTATOES

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Abstract

The effect of the application of the superadsorbent "Tverdaya Voda" on the productive and qualitative properties of potatoes was investigated in experiments set up at two localities (East Sarajevo and Bijeljina). A control variant, superadsorbent "Tverdaya Voda", was used for these tests; superadsorbent "Tverdaya Voda" enriched with growth stimulants; superadsorbent "Tverdaya Voda" enriched with microorganisms; superadsorbent "Tverdaya Voda" enriched with microelements and superadsorbent "Tverdaya Voda" enriched with growth stimulants, microorganisms and microelements in the amount of 20 kg ha⁻¹. From the productive properties of potatoes were analyzed: number of tubers per plant, mass of tubers, yield, and from qualitative properties: dry matter content, mineral content and starch content. Compared to the multi-year averages, 2019 is characterized by higher temperatures and higher amounts of precipitation. The application of superadsorbent enriched with growth stimulants, microorganisms and microelements gave the highest number of tubers, while the highest mass of tubers and the highest yield was achieved by applying superadsorbent enriched with microorganisms. At the locality in East Sarajevo, a larger number of tubers per plant was determined, while at the locality in Bijeljina, tubers of higher mass were obtained and a higher yield of tubers per unit area was achieved. In the variant with adsorbent-enriched microorganisms, the tubers had the highest dry matter content and the highest starch content, while the highest mineral content was obtained by applying a superadsorbent enriched with microelements. In the control variant, the tubers had the lowest content of dry matter and starch. At the locality of East Sarajevo, the tubers had a higher content of dry matter and starch, while the content of mineral substances was higher at the locality of Bijeljina.

Keywords: *superadsorbent, potato yield, locality, tuber quality.*

INFLUENCE OF INTERCROPPING SWEET SORGHUM WITH SOYBEAN 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 water per unit dry matter production of maize. Regarding high feed costs of protein supplementations, legumes can be used in livestock nutrition for their high protein content, thus, providing cost savings. Since legumes have low dry matter yield, acceptable forage yield and quality can be obtained from intercropping cereals and legumes compared with their sole crops. Sweet sorghum and soybean intercropped in various row ratios 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 over two years (20.6 t ha⁻¹) was produced by intercropping 1 row of sweet sorghum with 3 rows of soybean, whereas the lowest yield (17.9 t ha⁻¹) was produced with intercrop consisting of 1 row of sweet sorghum with 1 row of soybean. All intercropp had higher crude protein values in dry matter averaging 105 g kg⁻¹ for the 1SB1S, 116 g kg⁻¹ for the 1SB2S and 128 g kg⁻¹ for the 1SB3S, than the monocrop of sweet sorghum (72 g kg⁻¹). Intercropping of sweet sorghum with soybean reduced neutral detergent fiber content, which in turn, resulted in increased forage digestibility. Based on forage yield and quality, this study showed that among all intercropped forages the 1SB3S treatment was better performing than other intercrops.

Keywords: *Intercropping, Sweet Sorghum, Soybean, Yield, Forage Quality.*

APPLICATION OF STUTOX II. WITHIN AN EXTRAORDINARY SITUATION OF THE COMMON VOLE OVERPOPULATION IN THE AGRICULTURAL LANDSCAPE AND ITS LEGAL ASPECTS

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Abstract

At this time we face the exceptional situation of overpopulation of common vole in the Czech republic due to which significant damage arises in agricultural areas. Increased common vole population from 2016 to 2019 could be observed not only in the Czech Republic (2,4 times more) but also in Germany (2 times more), in Spain (7,4 /3,3 times more), in the Netherlands (5,9 times more) and in Hungary (2 times more). This article focus on the legal instruments by which farmers can defend their plant production against pests, in particular on the use of the plant protection product Stutox II and the regulation of these instruments with a simultaneous impact on biodiversity in the local (affected) areas. Stutox II. can be applied basically in two ways – directly into the rodent burrow or by spreading on the surface of the affected field. Farmers prefer the latter variant during a calamity situation – however, it is a threat to biodiversity, especially for wildlife. Unfortunately, the most endangered group are the natural enemies of the common vole, who often eat poison through their dead bodies. This exacerbates the problem of vole overgrowth. Other endangered animals eat the poison directly because of its nutritional content and the fact that it was applied to the field by spreading on its surface. Therefore we will analyze and critically evaluate relevant legal instruments, decipher collision between biodiversity and protection of plant and suggest some alternative solutions, including also farming method, which could help to avoid another common vole calamity and which would be even a beneficial for the environment.

Keywords: *Common vole, Overgrowth, Widespread application of poison.*

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 showed 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.*

EFFECT OF COLOR AND FLUX OF LED LIGHT ON GROWTH AND GRAFTING EFFICIENCY OF CUCUMBER SEEDLINGS

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Abstract

The aim of this experimental work is to study the influence of different light colors (white, red, blue, red + blue and green) and photosynthetic photon flux (25, 50 and 75 $\mu\text{mol m}^{-2} \text{s}^{-1}$) on growth of the grafted cucumber seedlings. LED lamps were used as source of light with different colors. The percentage of grafting efficiency (graft-take) was also calculated. The shoot length ranged from 7.97 to 9.66 cm, the stem diameter ranged from 4.007 to 4.785 mm, the leaves number ranged from 1.77 to 2.27 leaf/plant for, the leaf area ranged from 46.36 to 58.34 cm^2 , the chlorophyll content increased from 22.80 to 32.67, the shoot dry weight ranged from 366.19 to 410.39 mg, and the grafting efficiency ranged from 72.83 to 89.52 % for different light colors and photosynthetic photon fluxes (PPF).

Keywords: *grafting, LED light, photosynthetic photon flux, grafting efficiency, cucumber.*

CONTRIBUTION OF PEPPER (CAPSICUM SPP) PRODUCTION TO HOUSEHOLD FOOD SECURITY IN SHASHOGOWOREDA, HADIYA ZONE, ETHIOPIA

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Abstract

Pepper producing farmers in Ethiopia cling to solve the food security problems. However, information on the contribution of pepper to household food security is not adequate in Ethiopia. The purpose of this study was to investigate the status of pepper production and household food security in ShashogoWoreda, Hadiya Zone, SNNPR, and Ethiopia. The study employed cross sectional survey design which incorporates both quantitative and qualitative survey method. The data were collected from primary and secondary sources. Primary data were gathered by using structured household survey questioners, key informant interview and focus group discussions. For this study, data from 322 sample households were collected from three rural districts of Ethiopia. The data were analyzed by using SPSS software version 20. Population number increases from time to time whereas land holding size and soil fertility are declining. Therefore, to alleviate this problem providing training to family planning is essential. To reduce the problem of more sever land scarcity in the ShashogoWoreda to where there is available land within the region, ShashogoWoreda's government bodies should take this action into consideration enhancing farmers' indigenouse knowledge on preservation, storage, post-harvest management, saving, and diversifying income sources. To maximize agricultural production government should facilitate access of agricultural inputs in credit basis. In addition to that, to alleviate input cost problem, using compost instead of chemical fertilizers support poor households. Government should give high emphasis to increase food production and productivity of the farmers through improving better access and availability to improved agricultural technologies: promoting strategies such as crop diversification, providing of subsidized farm inputs to enhance households' food production and productivity. Livestock holding is one of the factors affecting the food security status of households in the study area. Therefore, based on the results of this study to improve production and productivity of the livestock, this will eventually increase food security situation of the rural households.

Keywords: *pepper, food security, household, production.*

STUDY OF THE ORGANOLEPTIC QUALITIES OF HOPS OF THE CASCADE VARIETY IN BEER, ACCORDING TO GEOGRAPHICAL ORIGIN

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Abstract

This study was carried out with the aim of determining whether the origin of the hops has an impact on the organoleptic qualities of the beer. Hops are composed of acids α and β , which mainly give bitterness, and essential oils which give beer its aroma. They are extracted by infusing the hops at 100°C during brewing or cold during fermentation. The hops used are of the Cascade variety and come from three different origins: American, French and German. In order to measure the differences caused by these origins, three types of brews have been made for the three origins, in order to bring out certain organoleptic qualities in particular. Thus, nine brews were brewed. Sensory analyses were carried out on the nine brews produced. The objective was to compare the organoleptic qualities of each beer according to the origin of the hops and the beer production process. Triangular tests were carried out with the aim of validating, or not, a significant difference between the samples in terms of taste, without looking at the nature and intensity of the difference. In the event that not all beers were perceived to be similar, a descriptive analysis was then conducted to quantify the observed differences. The results of the descriptive analysis showed a great similarity in terms of taste profile between American and German hops. They also revealed a real difference in taste, particularly in regards to the appreciation of the beers between these two origins and the hop of French origin.

Keywords: *Hop, Origin, beer, organoleptic qualities.*

VALUATION OF COFFEE GROUND THROUGH OPTIMIZATION OF PLEUROTUS OSTREATUS CULTURE PARAMETERS

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Abstract

The study focuses on the recovery of spent coffee grounds. The aim was to show that we could use coffee grounds as a substrate for the production of edible mushrooms. We used one of the most cultivated fungi in the world: the *Pleurotus Ostreatus* (the gray oyster mushroom). To compare the yields obtained, we sowed the mycelium on three substrates composed of different ratios of coffee grounds and wheat straws. We repeated the experiment three times. We also studied the impact of light during the fruiting phase: we placed half of the pouches in the dark during the whole experiment and did not observe any fructifications. We placed the other half under a light. We performed a statistical analysis such as a Kruskal-Wallis and principal component analysis. We demonstrated the existence of a negative correlation between the percentage of coffee grounds and the yield. To explain the poor development of oyster mushrooms on coffee grounds, we ventured various hypotheses. The main one is that as a substrate, spent coffee grounds may be too compact to be used alone. Yields would be higher if we mixed spent coffee grounds with another substrate that would compensate its compactness. Although the coffee grounds contain the nutrients needed to grow *Pleurotus Ostreatus*, the straw contains nutrients that also help grow (straw is very rich in polysaccharides). This study, therefore, helped to understand the roles of substrate and light on the growth of *Pleurotus Ostreatus*, and how to improve yields.

Keywords: *Pleurotus ostreatus, coffee grounds, substrate, wheat straw, recovery.*

EFFECT OF SOME WOOD ASHES AGAINST COWPEA SEED BEETLE *CALLOSOBRUCHUS MACULATUS* (F.)

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Abstract

The aim of this research was to study the effect of some wood ashes, apple, grape and olive, against Cowpea seed beetle *Callosobruchus maculatus* (F.) (Coleoptera, Bruchidae) adults at five concentrations: 5, 10, 20, 40 and 80 g/kg cowpea seeds. The study was carried out within the incubator at a constant temperature and relative humidity at the Biotechnology Research Center at Al-Baath University. Mortality rates were calculated after 3 days and effectiveness to reduce loss of seed weight damage rate and the reduction of adult emergence were calculated, in order to benefit from these results to implement an initial experiment at the warehouse level. The results showed the effectiveness of three wood ashes, increasing mortality rates with superiority to apple ash increasing by 85.43% and with significant deference in comparing with both grape ash 85.09% and olive ash 84.94%. The effectiveness increased with increase in the concentration. The relationship was positive between increasing concentration and increasing effectiveness on ashes in reducing seed loss, damage ratio and adult emergence. The effectiveness at concentration 10 g/kg were 88.84, 89.40, 88.81 % respectively, and the effectiveness increased at concentration 40 g/kg to 95.89, 96.13, and 95.89 % respectively. Apple ash was superior over grape and olive where effectiveness of apple ash in reducing weight loss, damage and adult emergence reached 93.96, 94.35 and 93.80%, respectively and for all the concentrations used, whereas it reached 91.21, 91.41 and 91.41%, respectively, in case of olive ash. Therefore, and by depending on these results, apple ash was chosen for use in an initial experiment at the warehouse level. This experiment have given promising and significant results in reducing the percentage of loss seed weight after 8 months of treatment and in increasing the amount of good seed compared to the untreated control, so it can be used in protection of seeds from infection with the cowpea seed beetle.

Keywords: *Effect, Wood ash, Cowpea seed beetle, Callosobruchus maculatus.*

A PRIMARY SURVEY FOR SOME WEED SPECIES AS HOSTS FOR MAIZE STEM BORERS IN DEIR EZZOR REGION, SYRIA

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Abstract

The aim of this research was to survey wild herbs species as secondary hosts of maize stem borers: *Sesamia cretica* Led., *Sesamia nonagriodes* Lef. and *Ostrinia nubilalis* (Hübner) in the Deir Ezzor region in eastern Syria, and to determine the period of its existence. The study was carried out during 2010 and 2011 by conducting a field survey of potential wild herbs species prevalent in the study area from April to December at an average of once a month. Incomplete insect stages (eggs, larvae, and pupae) were collected for the different yellow corn stalk excavators. These stages were transferred to the laboratory for further development of insect species. The results of the field survey showed four herbal species as hosts of maize stem borers. These species were distributed between three different families and three different orders. *S. cretica* was recorded on Wild Sugarcane *Saccharum aegyptium* L. (Cyperales, Poaceae) during months of May, October, November, and December, and on Johnson Grass *Sorghum halepense* (L.) Pers. 1805 (Cyperales, Poaceae) during months of May and October. *S. nonagriodes* was present on Lesser Bulrush *Typha angustifolia* L. (Typhaceae, Typhales) during months of May, October, November, and December. *O. nubilalis* was recorded on Jimson weed *Datura stramonium* L. (1753) (Solanaceae, Solanales) during months of June, July, August and September.

Keywords: *Weed species, Host range, Maize stem borers.*

BIOLOGY OF CONFUSED FLOUR BEETLE, *TRIBOLIUM CONFUSUM* JACQUELIN DU VAL IN GRAIN SILOS

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Abstract

This paper aimed to study variations in population of confused flour beetle, number of generations, monthly and seasonal abundance and relation of these variations with temperature and relative humidity. The study was conducted at Al-Waleed Silo in Homs, central Syria, from the beginning of September 2018 until the end of August 2019. Three pheromone traps of XlureMst were distributed inside the ground lanes in a silo. The data of the captured beetles was recorded in traps every week. Daily temperature and humidity were recorded. The results showed it was five generations, where the second generation was the longest (14 weeks) while the first generation was the shortest (6 weeks). The fifth generation was more abundance, while the second was the lowest. The relationship between variations of the population of adults and temperature was positive and significant ($r= 0.543$), while the relationship between it and relative humidity was negative and significant ($r= -0.515$). The lowest monthly abundance was 2 adults in February, and the highest was 75.67 adults in July.

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

GENETIC DIVERSITY OF GREEK AND BULGARIAN GRAPEVINE (*VITIS VINIFERA* L.) VARIETIES

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Abstract

The aim of this study was the identification and discrimination of Greek and Bulgarian grapevine (*Vitis vinifera*) varieties with the use of microsatellite markers. The studied samples were collected from various productive vineyards, consisting of eight Greek and nine Bulgarian native varieties. In order to create a genetic profile for each sample, a multiplex PCR reaction method was used amplifying simultaneously 10 microsatellites: *ssrVrZAG47*, *ssrVrZAG62*, *ssrVrZAG79*, *VVMD25*, *VVMD27*, *VVMD7*, *VVS2*, *VVMD5*, *ssrVrZAG67* and *scu05vv*. Statistical analysis of data showed that there was high degree of genetic heterogeneity among most of the varieties studied, allowing accurate identification of the investigated cultivars and highlighting, as well, the discriminative power of the chosen set of markers. Moreover, the synonymy of (I) Greek Pamidi and Bulgarian Pamid and (II) Greek Zoumiatiko and Bulgarian Dimyat was suggested, as each variety pair had identical allele profiles in all loci examined. Regarding Greek Mavrudi and Bulgarian Mavrud varieties, there was a close genetic relationship between them, however, they didn't share common alleles in all microsatellite loci and, therefore, should not be characterized as synonyms. On the other hand, Greek and Bulgarian Keratsuda which were supposed to be common varieties, they were found to be genetically different (at 1% level of significance), supporting that these two varieties should be considered as homonyms. Despite the genotypic assay performed herein, we believe that additional molecular work is needed for the efficient management of Greek and Bulgarian grapevine gene pool, as well as, to safely suggest any synonym or homonym annotation.

Keywords: *Grapevine, Genetic diversity, Microsatellite markers, Varieties, Vitis vinifera.*

EXPLORATION OF VITICULTURAL TASKS TO BE PERFORMED BY AN AUTONOMOUS ROBOT: POSSIBILITIES AND LIMITATIONS

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Abstract

In the past few decades, new technologies have entered the agricultural fields providing means of effectively managing vineyards, improving production quality and minimizing resources, while reducing production costs and achieving sustainability. In this context, robotics has been developed to support agriculture and already agricultural robots, namely *Agrobots*, are available in the market. Among several projects taking place worldwide, a prototype autonomous agrobot is currently being developed aiming to be used for vineyard management and harvesting grapes in vertical training systems. The agrobot of our interest combines commercial hardware and machine vision, contributing towards a reliable information acquisition system that includes sensor-fusion algorithms and data analysis. Seasonal cultivation practices applied to the vineyards include shoot removal, leaf removal and cluster thinning. Automation of these viticultural tasks, including harvesting, by means of agrobots is an increasing trend, characterized by efficiency and improvement of production quality. In this paper, the possibilities of implementing an autonomous agricultural robot for supporting vineyard management are discussed, focusing on summer pruning, i.e. leaf removal, cluster thinning and harvesting. In addition, limitations are presented, taking under consideration the conditions in Northern Greek vineyards. This work is based on interviews of expert agronomists and enologists of local wineries, and on the characteristics of 9 vineyards located in Northern Greece, based on vineyard management/ harvest reports and vineyard mapping. This study is part of the ongoing work of the national co-funded project POGHAR (Personalized Optimal Grape Harvest by Autonomous Robot).

Keywords: *leaf removal, harvesting, robot, vineyard, viticultural practices.*

SILAGE YIELD AND PROTEIN CONTENT OF FORAGELEGUMES INTERCROPPING WITH CEREALS

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Abstract

Intercropping of most annual legumes with winter cereals is a very common practice for forage production in many countries. The aim of this study was to determine the effect of intercropping cereals with forage legumes on silage yield and protein content. The completely randomized design was applied with three replications and the experiment was established in the farm of the Western Macedonia University in Florina. Particularly, common vetch, forage pea and faba beans were used as forage legumes, and barley, bread wheat and triticale were used as cereals, which were grown individually as well as intercropped with each other in mixed rows in a sowing ratio 65:35. The plots consisted of seven rows five meters long of which the five inner were harvested. A total of 45 experimental plots was installed. The field was fertilized only with base fertilization. All the cultural practices used by farmers were applied. The plants were harvested when the legumes were at the end of the flowering period and were dried naturally for the formation of hay. The plants were separated by hand to determine the weight of fresh matter for each species. Samples of 100 g of hay from each experimental plot were used to calculate the dry matter and to determine the total N using the Kjeldahl method and subsequently the total protein content. In most cases differences were found between the treatments concerning the dry matter and the protein content giving a better proportion in the mixtures.

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

YIELD OF GRAIN LEGUMES INTERCROPPING WITH CEREALS IN THE FLORINA AREA IN GREECE

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Abstract

Intercropping of two or more crops in the same area at the same time is an old and commonly used practice that results in the highest overall yield on a given plot, because of different root growth, height and nutrient requirements of the crops involved. The aim of this study was to determine the possibilities of intercropping grain legumes with cereals for food production for human consumption. The completely randomized design was applied with three replications and the experiment was established in the farm of the Western Macedonia University in Florina (Greece). Particularly, lentils (two varieties) was used as grain legumes, and bread wheat (two varieties) and oat were used as cereals, which were grown individually as well as intercropped with each other in mixed rows in a sowing ratio 50:50. The plots consisted of seven rows five meters long of which the five inner were harvested. A total of 33 experimental plots was installed. The field was fertilized only with base fertilization. During the growing season, the following morphological traits were measured: height and total height, the blooming, as well as the grain yield, the length of spike (cm) and the number of fertile grain/spike. Differences were found between treatments regarding yield as well as the agronomic traits. In most cases the mixture had higher yield compared to their respective monocrops.

Key words: *intercropping, yield, monocropping.*

EVALUATION OF MORPHOLOGICAL AND PHYTOCHEMICAL TRAITS AND PHYLOGENETICS RELATIONSHIPS OF SUMMER SAVORY (*SATUREJA HORTENSIS* L.) ACCESSIONS

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Abstract

Iran is one of the most important centers of savory variation and has been distributed in different regions from khorasan to west Azerbaijan. Summer savory contains thymol and carvacrol that are used in food and pharmaceutical industries as antioxidant and antimicrobial compounds. In this research, morphological, phytochemical and essential oil traits diversity in Iranian and foreign countries accessions of summer savory were evaluated. The results of this study showed that traits such as internodes number (10.33), shoot number (24.43), flower fresh and dry weight (34.53 and 3.33 respectively) were high variable and Ahvaz accessions were best in this traits and maximum essential oil volume (1.43%), flower number (121.39) were achieved by Greece accession. Correlation coefficients among traits showed that internode number had highest correlation with flower fresh weight (0.97). The path analysis showed that the internode number, length/width of bract, fresh weight of aerial part, bract fresh weight, flower dry weight and day to seed ripening had effect in essential oil content of accessions and flower dry weight had highest direct and positive effect (0.69). Cluster analysis based on Euclidean distance, divided the accessions into four major groups. Factor analysis indicated that seven factors explained 86.59 of the variability among the accessions. The results suggested that *S. hortensis* accessions of Iran and other countries had high genetic diversity and this diversity could be used in breeding programs.

Keywords: *Accession, Diversity, Essential oil, Morphological traits, Phytochemical characteristic.*

COMPARISON OF DROUGHT TOLERANCE IN DURUM WHEAT USING VARIOUS STRESS SELECTION INDICES

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Abstract

This study was performed to evaluate the ability of several selection indices to identify tolerant genotypes under a drought stress conditions. Fourteen durum wheat genotypes were evaluated under both drought stress and non-stress environments using twelve drought tolerance indices. Results showed that genotypes G3 and G4 were the highest yield non-stress condition, while genotype G8 displayed the highest performance under stress condition. The significant and positive correlation of YP with GMP, MP, STI, K₁STI, YP and HM indices indicated that these indices were more effective in identifying high yielding genotypes under non-stress condition while the positive association of YS with K₂STI indicated that this index was more effective in identifying high yielding genotypes under stress condition. Genotypes performed differently to drought stress, which justifies screening durum wheat for both yield and drought tolerance. Therefore, STI-based indices (STI, K₁STI and K₂STI) can discriminate drought tolerant genotypes with high grain yield under both non-stress and stress conditions. Finally, the genotype G3 besides genotype G8 were identified to be the most favorable genotypes and recommended for cultivation.

Keywords: *durum wheat, principle component analysis, tolerance indices.*

THE RESPONSE OF DETERIORATED SOYBEAN SEEDS AND *GAI1* AND *LOX2* GENES EXPRESSION TO ACC AND SALICYLIC ACID TREATMENT

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Abstract

Soybean (*Glycine max* (L.) Merrill) is the primary source of vegetable oil. Even in desirable conditions, soybean seeds lose their viability in long term storage. Many factors contribute to seed deterioration, including genetic factors, mechanical damage, relative humidity, storage temperature, seed moisture content, existence of microflora, and seed maturity, which reduce seed quality and make seeds unfit for cultivation purposes. In order to investigate the effects of seed deterioration on seed germination and also the effects of salicylic acid and ethylene on the improvement of deteriorated seeds of *G. max.*, accelerated aging test for 0, 6 and 10 days and natural aging test for 6 months were conducted. After aging conditions, seeds were imbibed with 50 μM salicylic acid and 10 μM ACC (precursor of ethylene) for 6 hours at 25 °C. In addition, after natural and accelerated aging tests, a bunch of seeds was used without any hormonal treatment (i.e., dry seeds) as control seeds. The seeds' germination percentage, total sugar, fructose, and glucose were investigated. Moreover, the gene expression of *GAI1* and *LOX1* was measured on dry seeds and under imbibition of water, salicylic acid and ACC at 6, 12 hours using Q-RT-PCR method. The germination results showed that increasing number of aging days led to a decrease in germination. Total sugar content in seeds aged for 6 days did not have a significant difference, as compared with non-aged seeds. However, total sugar content in seeds aged for 10 days was significantly higher than non-aged seeds. Increasing accelerated aging levels from 0 days to 10 days led to increases in glucose and fructose contents in dry seeds. In addition, genes exhibited different expressions in different days and hours. Increasing aging from 0 days to 10 days led to increases in *GAI1* gene expression. Moreover, *LOX2* expression increased in accelerated aging from 0 to 6 days. *LOX2* gene expression in naturally dried aged seeds also increased and was higher than that in non-aged seeds. SA and ACC had different effects on measured values. In general, it can be concluded that the deterioration of seed quality and vigor result from numerous degradation processes and disruption in seeds' physiological activity. This study showed that aging was associated with an increase in total sugar, glucose and fructose levels. In addition, the expression of the genes involved in the germination was also affected. Increases in *LOX2* gene expression were observed in both accelerated aging and natural aging pathways. *GAI1* gene expression increased in accelerated aging. However, in normal aging, it decreased.

Key words: Soybean, genes, seeds.

EFFCT OF NATURAL ZEOLIT AND DROUGHT STRESS ON SOME PHYSIOLOGICAL AND MORPHOLOGICAL TRAITS OF *FESTUCA ARUNDINACEA* GRASS

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Abstract

Grass is one of the most important components of landscape in the world. Zeolites due to their high CEC can play a nutritional role in addition to soil modification and improve plant growth especially in low cation exchange lands and in plants under drought stress. So, this study was designed to investigate the effect of zeolite and drought stress on physiological and morphological characteristics of *Festuca arundinacea* grass. A factorial experiment based on completely randomized design with 2 treatments and 3 replications was conducted in horticultural science greenhouses of Ferdowsi University of Mashhad, Iran, in 2019. Treatments included 3 levels of drought stress based on field capacity (FC): (100% (control), 50% and 25%) and 3 levels of zeolite mixed with loam: (0, 10% and 20% w / w). According to the results, drought levels resulted in reduced morphological traits, decreased RWC and increased EL, proline and total carbohydrate content in the plant. The interaction effects of zeolite and drought stress showed that treatment with 20% zeolite had the highest leaf area (31640 cm²), total dry weight (78.21 g) and carotenoids (2.16 mg / g fresh weight) and the lowest EL in non-stress conditions. Generally, drought levels of 50 and 25% increased the amount of carbohydrates and proline. Application of zeolites, especially at 20% level, increased morphological traits such as root and shoots dry weight, leaf area, height and carotenoids. In general, the application of zeolite has led to increased growth traits in grass under drought stress.

Keywords: *Carbohydrate, Chlorophyll, Ion leakage, Proline.*

INVESTIGATION OF PHYSICOCHEMICAL PROPERTIES OF SOME PLUM CULTIVARS OF IRAN

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Abstract

Plums have been known as one of the most diverse fruits in temperate regions, although their variation and diversity also cause differences in the physicochemical features of the fruit. Plums, on the other hand, owing to their high moisture content and short harvest season, are mostly and have been consumed. Therefore, the knowledge of characteristics of the cultivars and consider choosing the best drying conditions for drying in order to maintain the quality and nutritive value. The present study was conducted to investigate the physicochemical properties of 7 Iranian plum cultivars in a randomized complete block design with 5 replications. Plum cultivars with the usual names included: Ghatretala, Pivehzhah, Rotaby, Ghandy, Beygom, Torghabeh Sabz and Bokhara. Analysis of variance demonstrated that all cultivars had significant differences ($p < 0.01$) for all measurement indexes of chemical and physical features (except for kernel thickness). The results also showed that in most of the chemical features studied, cultivars including Beygom and Torghabeh Sabz were superior to other cultivars and had the highest amount of chemical compounds among the cultivars. The results also showed that there was a high amount of compounds such as antioxidants, flavonoids and vitamin C in the cultivars. Therefore, it can be said that some of the cultivars investigated in this study were rich in chemical combinations and had high nutritive values.

Keywords: *Antioxidant Capacity, dried plum, kernel thickness, Vitamin C.*

ANATOMICAL AND PHYSIOLOGICAL TRAITS OF BROAD BEAN (*VICIA FABA* L.) SEEDLING AFFECTED BY SALICYLIC ACID AND SALT STRESS

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Abstract

A laboratory experiment was carried out at the College of Agriculture University of Baghdad (the Republic of Iraq) in 2019. The aim was to improve the anatomical and physiological traits of broad bean seedling under salt stress by soaking it in salicylic acid. The concentrations of salicylic acid were 0, 10, and 20 mg L⁻¹ and the electrical conductivity levels were 0, 3, and 6 dS m⁻¹. The complete randomized design was used with four replications. The increasing of salicylic acid concentration up to 10 mg L⁻¹ led to increasing the stem cortex thickness, stem vascular bundles thickness, and root cortex thickness significantly by 34.9, 36.7, and 55 μm respectively, while the treatment of 20 mg L⁻¹ led to decreasing these traits by 28.2, 27.8, and 48.1 μm, compared to control treatment (33.8, 35.9, and 53.8 μm), respectively, and the interaction of studied factors led to increasing those traits up to 10 mg L⁻¹ and then decreased up to 20 mg L⁻¹ of salicylic acid under each level of electrical conductivity. Therefore, it is recommended to soak the broad bean seeds with 10 mg L⁻¹ salicylic acid to improve the anatomical traits of seedlings and increase their tolerance to salt stress up to 6 dS m⁻¹.

Keywords: *Stem and root anatomy, Broad bean, Salicylic acid (SA), Salt stress, Epidermis.*

STEVIOSIDES COMPOSITION IN STEVIA REBAUDIANA BERTONI: EFFECT OF DRYING METHODS

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Abstract

A field experiment was carried out in the field of experiments of the Medical and Aromatic Plants Research Unit at the College of Agriculture, University of Baghdad, Iraq in 2019 on *Stevia rebaudiana* plant as a comparison guide of eight drying methods on total glycoside composition in leaves and branches. A complete randomized block design (RCBD) was used with three replications. The drying treatments were: solar drying, shade, oven (40°C, 50°C, and 60°C), and microwave (for 1, 2, and 3 minutes). The results showed that the highest dry matter percentage in leaves was reached at drying by shade and microwave for 2 minutes (23.52% and 22.81%, respectively) and the best composition of total glycoside sweetener including of stevioside (St) and rebaudioside A (Reb A) reached by solar drying and oven at 50°C was 7.86% and 7.84%, respectively. In the branches, the highest percentage was at drying by shade and microwave for 1 minute 20.14% and 20.09%, respectively, while the highest percentage of sweetener was by drying in oven (60°C) and microwave for 2 minutes 0.355% and 0.350%, respectively, followed by the same content by solar drying and oven at 50°C (0.255%).

Key words: *Stevia, drying method, dry matter, stevioside.*

PHENOTYPIC AND MORPHOLOGICAL CHARACTERIZATION OF THE ROOT SYSTEM ARCHITECTURE IN LOW PHYTIC ACID1-1 MAIZE MUTANT

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Abstract

Phytic acid (PA) represents the major storage form of phosphate (P) in the seeds. It is accumulated as phytate salts with different cations, reducing their bioavailability. Only ruminants can degrade PA, while monogastrics assimilate 10% of phytate in feed and 90% is excreted, contributing to P pollution. Hence, many low phytic acid (*lpa*) mutants have been isolated in all major crops. The *lpa* trait can provide several potential benefits to the nutritional quality of foods and feeds and to the environmental P sustainability in agriculture. Among different *lpa* mutants in maize, *lpa1-1* is characterized by a 66% reduction in PA, followed by a proportional increase in inorganic P. PA decrease is often accompanied by negative pleiotropic effects on the seed and on plant performance. One of the agronomic defects observed on *lpa1-1* in field conditions is a greater susceptibility to drought stress, which could be caused by an alteration in the root system architecture (RSA). With the aim to assess the effect of drought stress on the mutant, we have compared the RSA of *lpa1-1* to a wild phenotype, using hydroponic cultivation and two soil conditions (pots and field). In this work we present the first results obtained in hydroponics tests and pots experiments, which clearly show a variety of morphological changes in the mutant root system. If these alterations will be confirmed in the field (summer 2020), the RSA would play a key role in drought stress sensitivity, thus representing an important objective of *lpa* genetic improvement programs.

Keywords: *phytic acid, low phytic acid mutants, maize, root system architecture, phenotyping.*

PIGMENTED MAIZE COBS WASTE AS SOURCE OF NUTRACEUTICAL PRODUCT AND ENVIRONMENTAL FRIENDLY SOLUTION TO DYE NATURAL FIBERS

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Abstract

Maize cultivated worldwide has yellow kernels although several maize varieties are able to accumulate pigments in different tissues. These pigments are mainly anthocyanins that belong to the class of flavonoids. Different epidemiological and preclinical studies have demonstrated that regular consumption of anthocyanins rich food is associated to a reduced risk of chronic diseases, as cardiovascular diseases, cancer and obesity. Furthermore, these pigments could be used to dye natural fibers in a context of sustainable circular economy due to the fact that textile industry consumes a significant amount of water in its manufacturing processes, mainly during dyeing and finishing dyeing operations. The aim of the PASTEL project (Granted by Cariplo Foundation) is to develop nutraceutical products and a natural dyeing process for natural fibers using anthocyanins extracted from maize cobs, i.e. the residual waste coming from the cultivation of red corn. With this purpose we studied new materials and traditional varieties to find the best candidates for anthocyanins production. The varieties selected for anthocyanins production carry the two strong regulatory genes involved in flavonoids synthesis P1 (purple plant1) and B1 (Booster 1), leading anthocyanins synthesis in pericarp. We set up a quick and cheap extraction method starting from dried cobs to obtain the flavonoid pigments used to stain different natural fibers (wool, silk, cotton and flax). HPLC-MS analyses have been performed on the different repartitions water/ethanol extracts to individuate the best composition for the staining process. In this poster we will present preliminary data regarding the entire process.

Key words: *anthocyanins, maize cobs, natural dye.*

A. DONAX L. CLONE SELECTION FOR ENHANCED ANTHOCYANINS PRODUCTION

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Abstract

The selection of interesting phenotypes and ecotypes always represented the starting point in domestication processes and in many genetic improvement programs. Exploring natural variability plays an essential role to value the genetic resources of any species, even more in sterile species with assessed low genetic diversity, like *A. donax* L. We approached the selection of desirable traits by tissue culture methods, in 4 different Italian clones of *A. donax* L. (Ad11, Ad47, Ad67, Ad76), considering: a) regeneration potential from undifferentiated callus; b) anthocyanin production in observed phenotypes. White-yellow totipotent calli were subcultured on auxin supplemented MS medium for two years then induced to regeneration by auxin starvation on different media. Each explant was then evaluated with a semi-quantitative method, to highlight red pigmentation and regeneration events. Red pigments are stored in small amounts and in transient stages, browning to black along subcultures. Explants of clone Ad47 exhibited reddish tissues with higher frequency, and 3 best explants on a pro-embryogenic level. These explants were selected to constitute the callus lines (E8, E18 and E19). The phenotype Ad47 exhibited high anthocyanins production also during embryogenesis, shoot culture and cuttings propagation. The characterization of extracted anthocyanins by HPLC analysis highlighted the predominance of cyanidin 3-glucoside (C3G) in sun dried red canes of *A. donax* L. Molecular analysis of the DNA sequence of C1-like putative transcription factor suggested a role in anthocyanins biosynthetic pathway in *A. donax* L.

Keywords: *A. donax* L., clone selection, tissue culture, anthocyanins, transcription factor.

EFFECT OF NITROGEN AND PLANT DENSITY ON SOME PROPERTIES OF GROWTH AND YIELD COMPONENTS FOR TWO VARIETIES OF SORGHUM BICOLOR L. MOENCH

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Abstract

Effects of different nitrogen levels and plant inter-row spacing on growth, physiological, yield traits and hydrocyanic acid content of two sorghum varieties were studied. The experiment was carried out on the farm of the glasshouses project of Misurata city-Libya. The experimental site was 32°16'10.10" N 15°02'49.66" E. Seeds of Sorghum bicolor (L) cv. Azra3 and Azra7. using (RCBD) Split-split arrangement was chosen to allocate the treatments i.e.: two inter-row plant spacing and 5 levels of nitrogen which were randomly assigned to the experimental units. Regarding the physiological parameters, measured results revealed that nitrogen and plant inter-row spacing had a significant effect on chlorophyll content and leaf area of the plants. Cultivar Azra7 had large leaf area and higher chlorophyll content under large plant inter-row spacing and 200 kgNha⁻¹ as compared to that of Azra3. The yield and the yield component were significantly affected by treatments applied in this experiment. Cultivar Azra7 gave significantly higher yield grain under narrow inter plant spacing and 200kgNha⁻¹. Concerning the effect of treatments tested on the content of hydrocyanic acid of two cultivars, the results showed significant difference .

Keywords: *Sorghum , Nitrogen, Growth, Yield, hydrocyanic acid.*

DSSAT MODEL EFFICIENCY FOR YIELD AND NITROGEN BUDGET ESTIMATION UNDER MINERAL AND ORGANIC FERTILIZATION

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Abstract

In order to secure stable and profitable yields, high nutrient use efficiency as well as low environment impact, it is necessary to tailor grain maize fertilization practices to sub-optimal local weather conditions typical for nemoral climate zone. This study is a first attempt to assess and compare the main N cycle parameters in grain maize crop after application of synthetic and different organic fertilizers solely or in combination in nemoral zone maize, via modelling. The model showed particularly good agreement between simulated and measured maize total biomass and grain yields data. The model also provided a reasonable simulation of soil water content and temperature evolution during the maize growing season, which was an essential precondition for reliable prediction of N cycling pattern. The reasonable fit between simulated and experimental values of N uptake and soil mineral nitrogen was found. The model separated well differences among treatments: lower N uptake and SMN in PCM and GWC than that of AN, with intermediate results in PPM and AN combined with organic fertilizers. The model also provided with relevant estimations of N losses occurring during maize growing seasons via leaching and gaseous emissions. Our study suggests that DSSAT model can successfully capture weather and N management factors relevant for maize yield formation process under the climate of the nemoral zone. However, additional efforts are needed to verify and to tune fine this model to comprehensive simulation of N cycle, losses to water and air in particular.

Keywords: *DSSAT model, N uptake, soil mineral nitrogen, N losses.*

ANALYSIS OF EXPLOITATION AND ECONOMIC PARAMETERS IN DIFFERENT WAYS OF HARVESTING SOUR CHERRIES (*PRUNUS CERASUS*)

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Abstract

The Republic of North Macedonia has excellent climatic and soil conditions for the development of fruit production in different regions, especially for the development of the production of bone fruit - sour cherry (*Prunus cerasus*). It is a culture, the fruit of which is required for fresh consumption, but also as a raw material in the confectionery industry, the canning industry, as well as the industry for the production of alcoholic beverages. Today it is grown on intensive plantations, with full implementation of modern techniques and technology. The biggest problem in sour cherry production is its harvest. In the past, this was done manually, but today, as a result of expensive labor, but also the lack of workers, owners of larger areas planted with sour cherry, have been forced to purchase modern harvesting machines. They do this in order to reduce the cost of harvesting, as most of the total cost falls on this work process. In this scientific paper, a comparison will be made of the exploitation and economic parameters, when using different ways of harvesting.

Keywords: *combine harvester, exploitation, sour cherry.*

SOME BIO-MORPHOLOGICAL CHARACTERISTICS OF BURLEY TOBACCO VARIETIES AND LINES IN THE PRODUCTION REGION OF PRILEP (NORTH MACEDONIA)

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Abstract

Throughout 2018 and 2019 trials were conducted on the fields of the Scientific Tobacco Institute – Prilep, with four burley varieties (Enchu Ø, B-D-1, Banket A₁, Habana – 92 and two domestic male sterile hybrid lines, B-210/15 CMS F₁ and B-199/11 CMS F₁). The American fertile variety Enchu Ø was used as a control. The examinations were conducted on diluvial soil, using randomized block at 90 x 50 cm spacing design with 4 replications and the obtained results were statistically processed by variance analysis method and were tested with LSD test. During the growing season, morphological measurements were made on 20 stalks of each variety, and the following data were analyzed measurements were performed after harvesting; after each leaf from different stalk position reaches technological maturity: length and width of the 5th, 10th and 15th leaf. In most of these characteristics, the male home varieties proved to be superior to the fertile variety Enchu Ø, and the male sterile hybrid lines proved to be superior to the fertile genotypes B-199/11 CMS F₁ and B-210/15 CMS F₁ created in the Scientific Tobacco Institute - Prilep, North Macedonia. Its high yields and typical Burley characteristics make this male sterile hybrid lines attractive both for farmers and for manufacturers. In the present conditions, it can play the role of an initial variety for restarting the production of Burley tobacco in North Macedonia, but it can also be interesting for our neighboring countries and beyond. The obtained results can help producers make a decision in regard to the genotype that they will use in the start of the production cycle.

Keywords: *tobacco, variety, Burley tobacco, leaves.*

CHIPILÍN BIOMASS PRODUCTION OF *Crotalaria longirostrata* Hook & Arn UNDER DIFFERENT FORMULATIONS OF FERTILIZATION AND SOLAR RADIATION LEVELS

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Abstract

Chipilín is a shrub species that grows wild in the tropical areas of Mexico and whose crude protein content is 31%. It is linked to food culture, mainly of the rural population. It is frequently found associated among tropical crops. Despite the fact that it is a plant genetic resource appreciated by rural families, its use continues to depend essentially on its natural reproduction and collection, perhaps because almost everything about the agronomic management of the plant is unknown. The objective of this work was to study the growth response and production of foliar biomass of *Crotalaria longirostrata* supplying different fertilization formulations (N, P and K) and different levels of solar radiation. A 3 x 3 factorial experiment was carried out, in a completely randomized design. The formulations were 45-30-26, 17-00-00 and 00-00-00, and the radiation levels were 50%, 65% and 100%, resulting in 9 treatments with 8 repetitions; and as an experimental unit a pot with a plant was considered. The results indicate significant differences ($p < 0.05$) between formulations, and solar radiation levels for all the variables considered, such as basal stem diameter, number of lateral branches, dry biomass of stem, leaf and root. In all cases the formulation 45-30-26 turned out to be better, for example at 100 days the amount of dry leaf biomass was 17.5 grams per plant, while with the formulations of 17-00-00 and 00-00-00 was 6.0 and 3.5 grams per plant respectively. In the case of solar radiation, 15.0, 8.0 and 3.0 grams were obtained for 100%, 65% and 50% respectively. Therefore it is concluded that the best formulation and percentage of solar radiation for the production of *Crotalaria longirostrata* is 45-30-26 with 100% solar radiation, and that the amount of total fresh biomass that a plant can produce depends on the basal diameter of its stem.

Key words: *Phylogenetic resource, formulation, solar radiation, dry biomass.*

GROWTH PARTICULARITIES OF AMERICAN POKEWEED – PLANT WITH MULTIPURPOSE UTILIZATION

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Abstract

American pokeweed (*Phytolacca americana* L.) is a good ornamental plant due to its ability to grow rapidly, broad and tall vegetation, and attractive grape-like fruits. However, American pokeweed and some useful chemical constituents, which accumulate in different parts of this plant, until present, in our opinion, are not utilised sufficient effectively. The leaves and seeds of *Phytolacca americana* L. produce pokeweed antiviral protein with increased antiviral and antifungal activities. Natural dyes accumulated in fruits can be used in the food, cosmetic, pharmaceutical and textile industries. The purpose of this work was to study the growth particularities of pokeweed plants propagated by seeds, and to establish the content and antioxidant activity of main constituents (polyphenols and colorant substances) in ripe fruits. American pokeweed demonstrated the excellent adaptivity of seeds and seedlings under different condition of germination, transplantation and cultivation. In season of 2019, the vegetation cycle of *Phytolacca americana* L. annual plants continued maximal 210 days (from March to November). The biometrical indexes of stems, racemes, fruits and seeds corresponded to similar characters reported by other scientists. The aqueous and hydroalcoholic extracts were obtained from ripe fresh fruits. The biggest amount of polyphenolic and colorant substances was found in aqueous extracts. The antioxidant activity of *Phytolacca americana* L. fruit extracts, evaluated *in vitro* by potentiometric procedure against the peroxy free radicals, was in direct proportion to the content of polyphenols ($r^2=0.9563$) and colorant substances ($r^2=0.9808$). The colorant substances from American pokeweed fruits possessed the high antioxidant activity, IC_{50} was equal to 259.65 ± 2.60 mg/l.

Keywords: *American pokeweed, growth particularities, fruit, colorant substances.*

THE EFFECT OF THE PHYTOHORMONE IBA ON THE SCARATION OF MATURE EYES OF VEGETATIVE GISEL SUBSTANCE 5

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Abstract

This paper presents the results of exogenous application of different concentrations (1000, 2000, 3000 and 4000 ppm) of the phytohormone Indol - butyric acid (IBA) to the rooting of mature cuttings of Gisela 5 medium. The research was conducted in a closed space (greenhouse) of the nursery "Čuljak" in Čapljina in Bosnia and Herzegovina (Entity of Federation of Bosnia and Herzegovina), during 2018. Agroperlite substrate was used for rooting. The experiment was set up in the block system by the method of random sampling in three replications. The temperature and humidity in the greenhouse were controlled. Different influence of exogenous application of phytohormone IBA (1000, 2000, 3000 and 4000 ppm) on the success of rooting of mature cuttings of Gisela 5 substrate was stated. The weakest rooting of mature cuttings of Gisela 5 was found when using IBA at a concentration of 1000 ppm and amounted to 43,52%, and the best rooting was determined using IBA at a concentration of 4000 ppm and amounted to 61,50%. Analysis of variance and LSD test revealed statistically highly significant differences in the success of rooting cuttings of the examined Gisela 5 medium, where the success of rhizogenesis depends on the concentration of phytohormone IBA with which the cuttings were treated. The use of IBA solution (4000 ppm) has been shown to be the best in the process of rhizogenesis and as such can be recommended in the Gisele 5 substrate production technology used to raise cherry orchards in a dense assembly.

Keywords: *variety, phytohormone, cuttings, scarring, concentratio.*

ANTIOXIDANT PROPERTIES AND AMINO-ACIDS CONTENTS OF ROTHMAS AND KAOLAK CULTIVARS OF WATERMELON AS INFLUENCED BY NPK FERTILIZER

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Abstract

Importance of fruits and vegetables in diet and health cannot be over emphasized. Cultivation practices can, however, influence the health substances contained in fruits and vegetables. Hence, field experiment on watermelon was carried out from September to December in 2016 at the Teaching and Research Farm of Osun State University, Nigeria. Influence of NPK 15:15:15 fertilizer at different rates (0, 100, 200 and 300kg/ha) was evaluated on Kaolak (hybrid) and Rothmas (local) of watermelon. 200kg/ha of the fertilizer was found to bring out the optimal yield of both cultivars. Hence, at 0kg/ha and 200kg/ha, mature fruits of the cultivars were analyzed for the antioxidants and amino-acids using standard analytical methods. Antioxidant properties of Rothmas were found to be significantly higher than those of Kaolak with the exception of the radical scavenging ability, lycopene content and metal chelating ability of Kaolak. Fruits that received no fertilizer across the cultivars exhibited more antioxidant potency compared to fruits under 200kg. From the amino acids analyzed, threonine, serine, glutamic-acid, alanine, valine, phenylalanine and arginine in Rothmas were significantly higher compared to the contents in Kaolak. Except for tryptophan, alanine, lysine and phenylalanine, fruits that received no fertilizer had higher contents of amino acids. Where fertilizer is needed to boost soil fertility, a lower rate than 200kg/ha of NPK fertilizer needs to be applied so as not to compromise the health-giving substances in the fruits. Local landraces of fruits and vegetables obviously have to be brought into limelight through research.

Key words: *Vegetable, Cultivar, Protein, Health substance, Watermelon.*

INVESTIGATION ON PHOTOSYNTHETIC METABOLITES OF DILL (*ANETHUM GRAVEOLENS* L.) GROWN UNDER EXOGENOUS SUPPLY OF SOME SELECTED PHYTOHORMONES.

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Abstract

Anethum graveolens is frequently grown as herb and essential oil is used in pharmaceutical and agro-chemical industries. An experiment was performed by growing plants in pot, in Botany Department University of Azad Jammu and Kashmir (AJK) Muzaffarabad, Pakistan. The objective of the experiments was to test the efficiency of leaf applied salicylic acid (SA) and gibberellic acid (GA₃) on photosynthetic metabolites (soluble sugar, insoluble sugar, total carbohydrate, carbohydrate yield, protein contents, protein yield, flavonoid content, flavonoid yield, phenol content, phenol yield, indole content, indole yield, vitamin A content, vitamin A yield, vitamin B₆ content, vitamin B₆ yield, vitamin C content and vitamin C yield). The plants were sprayed with different concentration of salicylic acid (SA) (10⁻⁴ MSA, 10⁻³ MSA) or gibberellic acid (GA₃) (10⁻⁴ M GA₃, 10⁻³ M GA₃) and deionized water as a control (W₀) after 50 days of sowing (DAS) and were harvested at 90 days after sowing. The result showed that the applied salicylic acid and gibberellic acid showed significant effects on most of the studied characteristics. The maximum response for vitamin B₆ content was noted for GA₃ at the rate of 10⁻³ M however the application of SA at the concentration of 10⁻⁴ M ascertained best for most of the traits of studied plant. It has been concluded that the leaf applied SA proved best for the performance of *Anethum graveolens*.

Key words: *Anethum graveolens*, Gibberellic acid, Phytohormones, Salicylic acid.

EFFECT OF BIO, ORGANIC AND INORGANIC FERTILIZATION ON POTATO GROWTH AND PRODUCTIVITY IN PALESTINE

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Abstract

A bio, an organic and an inorganic fertilization trial was carried out on potato (*Solanum tuberosum* L.). Nine treatments were investigated: fertilization program recommended by Ministry of Agriculture (MoAP) 200N + 150P₂O₅ + 300 K₂O Kg Ha⁻¹ + 3m³ poultry manure (PM) as a control (T1), 75% MoAP + biofertilizer (T2), 50% MoAP + biofertilizer (T3), 75% MoAP (25% NPK + 75% PM) + biofertilizer (T4), 50% MoAP (25% NPK + 75% PM) + biofertilizer (T5), 100% PM + biofertilizer (T6), 75% MoAP (25% NPK + 75% compost) + biofertilizer (T7), 50% MoAP (25% NPK + 75% compost) + biofertilizer (T8), 100% compost + biofertilizer (T9). Results revealed that T6, T2, and T4 insignificantly had longer plants while T6 produced the significantly highest number of stems, the weight of the plant, and the insignificantly heaviest tuber. T6 and T7 showed the significant highest leaf nitrogen content and T7 had the significant highest leaf phosphorus content. All treatments insignificantly decreased tuber diameter, yield, number of tuber and leaf potassium content than control, where tuber length, tuber specific gravity, dry matter, tuber starch, total protein, tuber grades, and total leaf chlorophyll were not significantly affected. It could be recommended to apply 100% Poultry manure(5 ton Donum⁻¹) + biofertilizer on the potato crops.

Keywords: *Bio-fertilization, manuring, potato yield, tubers, leaves.*

RELATIONSHIPS BETWEEN THE INFLUENCE FACTORS OF THE SOIL TILLAGE PROCESS

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Abstract

It is known that the soil tillage process for the sowing of the crops is one of the most important agricultural works involving both large energy consumption and high costs. The quality of seed-bed preparation influences the degree of germination and crop productivity. The soil tillage process is influenced by many factors. Usually, these factors are: pedological factors (soil texture, organic matter, clay mineralogy, soil structure, soil bulk density, moisture content, respectively: external friction, soil-metal adherence, soil cohesion, soil resistance to penetration), technological factors (forward speed, working depth, working width), and constructive factors (type of tool, geometry of tool, technical condition of tool, adjustment mode of tool). All these factors determine the mechanical energy necessary to effectuate the soil tillage process, energy which contain the following terms: energy required to cut the soil, energy required to overcome the external friction forces, energy required to move the soil, energy required to overcome the adhesion forces, energy required for displacement of the tools, and the energy required to overcome the inertia forces (if the speed of the agricultural machine is not constant). In this paper, more complex scheme of the soil tillage process and the relationships between the factors of influence are presented, with concrete application for the agricultural vibro-cultivator used in conservation tillage systems, which can make the preparation of the seed-bed for sowing in one pass with minimum consumption of energy, without causing the degradation of agricultural soil.

Keywords: *Agricultural machine, Tillage, Mathematical modeling, Vibro-cultivator.*

THE INFLUENCE OF CROP ROTATION AND NUTRITION REGIME ON THE QUALITY INDICATORS OF SEEDS IN WINTER WHEAT IN THE REGION OF CAREI, SATU MARE COUNTY, ROMANIA

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Abstract

The experiment was made in the region of Carei, Satu Mare county, Romania, in the period 2017-2019, on the chernozem. For "Glosa" winter wheat grains a series of chemical test were made regarding the content of nitrogen, phosphorus, potassium and raw protein according to the precursory and the nutrition system. The nitrogen was determined using the Kjeldahl method, the phosphorus was determined by colorimetry with ammonium molybdate and tin chloride reduction. The potassium was determined through flame photometry and the raw protein was determined through calculation ($N_t \times 5.7 \%$). The quality of production is related to a series of physical and chemical characteristics of plants which gives a positive mark to the applied agrotechnical methods for the correlation of the latter to the production obtained on the surface unit. The crop rotation is a decisive factor influencing growth and development of wheat.

Keywords: *Crop rotation, nutrition regime, nitrogen, phosphorus, potassium, winter wheat.*

COMPARATIVE EXPERIMENT OF SEVERAL EARLY SWEET CORN VARIETIES

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Abstract

According to data, sweet corn is the vegetable which is grown on the greatest area in Hungary. The aim of paper was to evaluate some important morphological properties of several early sweet corn varieties for fresh consumption market, in low cost technology for small producers. The experiment was set up in 2016 in Tg-Mures, Mures County, situated in Central part of Romania. The choosen varieties: a conventional, very early ripening, normal sweet hybrid, „Spirit” which is used as a reference variety in the variety comparison trials conducted by Central Agricultural Office, then early ripening, normal sweet hybrid, „Mv. Július” and early ripening, super sweet hybrid „Sweet Star”. The compared varieties could have been recommended as adaptable for meteorological and pedological conditions of Central part of Romania. No growing period shortening technologies were applied but direct sowing of plants without row cover, normal period (third decade of April). Results showed the influence of variety on some important morphological properties of sweet corn ears: weight of husked and unhusked ears, ear length, ear diameter, length of kernel.

Key words: *earliness, sweet corn, normal sweet, super sweet.*

EXPERIMENTAL RESEARCH FOR THE DETERMINATION OF FRACTURE EFFICIENCY OF TRACTORS

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Abstract

This paper seeks to determine the braking parameters of agricultural tractors produced in Romania for admission in road traffic on public roads as well as agricultural aggregate tractors, imposed by national, European and international norms, so as to ensure safety and security in the transport, which is verified by the test of: tractor, agricultural trailer, tractor components and trailers (assemblies) that directly compete for safety and security in transport: traction device for wheeled tractors, mating eyes for biax trailer or uniaxial. In order to verify compliance with the safety and security requirements in transport, experimental research was carried out on a U-774 DT agricultural tractor, a REMO RAB type 4 trailer, a tractor traction device, a towing eye from the trailer . In the tests, several parameters were determined: the determination of the longitudinal braking stability by the calculation of the experimental method, the determination of the braking efficiency, the braking with the parking brake, the braking with the service brake. All the tests performed on the tractors, the most important type approvals are braking efficiency, as it has the greatest impact on road safety.(Beghes H.,Popescu ,S, Popa L 2002; Iordache S,Badescu M ,Boruz S,Vladut V,Eng Popa L 2011). The tests were carried out on a concrete track designed for braking tests, brake test items were mounted on the tractor, or several attempts were made for service braking and stationary braking at different speeds. The results were interpreted graphically, and centralized tables, conclusions were drawn and made proposals to improve the braking system.

Keywords: *tractor, braking, agricultural trailer, trials.*

A METHOD OF APPROXIMATING THE AREA SWEEPED BY A BODY MOVING ON A PLANE

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Abstract

The paper presents a practical method of approximation of the area of the planar zone swept by a body in rotational and translational motion on that plane. Although theoretical solutions might be found, there are reasons why these are not practical for more complicated movements than the pure translational or rotational. First is that of measuring only once the areas of the plane portions several times swept. The second consists of the difficulties of delimiting the areas several times swept by the moving body. The proposed method consists of processing the digitized images from the graphical results of the numerical simulations or the photographs of the "traces" left on the plane of movement by the body in motion. The mathematical model of the planar motion of a rigid solid simulates the movement of working bodies of some agricultural machines that soil tillage, having relative movements to the load-bearing structure. The results presented include the validation of the method for pure translational and pure rotation movements. For the case of the general flat rotational and translational movement, results are given for several sizes of the digitization matrix. Also in the article are highlighted the parameters of the physical process that influence the ratio between the area swept and the area of the translation travel corridor.

Keywords: *swept, area, estimation, image, processing.*

RESEARCH AND ANALYSIS OF VIBRATORY EQUIPMENT USED TO PREVENT OR MINIMIZE SOIL DEGRADATION

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Abstract

This paper deals with the status of research and with the analysis of vibratory working tools used in tillage operations. At this moment, one of the most important topics for the engineers and manufacturers is to achieve the best productivity with the least energy required. This can be accomplished by reducing the draft force which results in least power consumption by the tractor. Various works by researchers on types and models of vibratory working tools have been taken into consideration. Soil is the main mean of production in agriculture, which is irreproducible and inextensible, so it must be treated for with great care, ensuring that its maximum exploitation is the fundamental preoccupation of each country and of all specialists in the field. Although Romania has soils with big potential, aggressive weather conditions and unreasonable application of fertilizers has led to today's situation where most of the land plots have no optimal parameters to obtain maximum yields. Soil characteristics vary from one area to another depending on many factors, such as climate and altitude. In each climatic zone, one type of soil predominates. From the analysis of the literature results the possibility of using vibrations in the realization of the working processes of the agricultural machines in order to fulfill one or more aspects. Thus a study has been conducted to identify the advantages of the vibratory equipment over the rigid one. Also a finite element method analysis has been made on one active tool to observe the specific deformations and displacements.

Keywords: *Vibratory Equipment, Draft Force, Finite Elements Method, Agricultural Soil.*

INFLUENCE OF SOIL TILLAGE SYSTEM ON THE SOIL AND SOYBEAN PRODUCTION

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Abstract

The paper aims to research the influence of the tillage system in relation to the amount of plant vegetal debris in soybean crop. We will present the impact of the soil tillage system and graduation of quantity of vegetal debris upon the characteristics of soil (especially humidity and bulk density) as well as upon the production of soybean crop. The experience was placed on a Chernozem soil, during 2014-2019. Experimental factors established were: Factor A-Crop: a₁-soybean; a₂-wheat; a₃-maize; Factor B-Soil tillage system: b₁-conventional system: reverse plough + disk 2x + sowed + fertilized (witness); b₂-conservative system with minimum tillage: chisel + rotary harrow + sowed + fertilized; b₃-conservative system with direct sowing (sowed- fertilized-herbicides); Factor C-Vegetal debris:c₁- 60% (3 t/ha);c₂- 80% (4 t/ha);c₃-100% (5 t/ha). The experimental field is located in the physical-geographical unit of the Transylvanian Plain. Transylvanian Plain is an agricultural area with fertile soils, suitable in terms of thermal resources, but with restrictions in terms of water resources, for soybean crop. The soil moisture was influenced significantly by the quantity of vegetal debris from the soil surface, and to a less extent by the soil tillage system. In exchange, bulk density was influenced especially by the soil tillage system, with lower values (1.18-1.25 g/cm³) in the case of the conventional system with plough, respectively higher values (1.22-1.38 g/cm³) in the case of direct sowing. The tillage system influenced the development of nodules, productivity elements and finally soybean production. The soy production ranged between 2582-2898 kg/ha, being more related with the soil moisture and less related with the tillage system.

Keywords: *conservative agriculture, increasing resilience to drought, soybean production.*

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MODEL OF BIOCLIMATIC POTENTIAL OF LEGUME PERENNIAL AGROPHYTOCENOSES IN THE MIDDLE PREDURALIE, RUSSIA

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Abstract

The model of legume perennial agrophytocenoses adapted by agrobioclimatic, biophenological and productive potential has been studied in the conditions of the Middle Preduralie, Russia and proposed to local farmers. Effective and multivariate cultivation technology methods allow maintaining a positive dynamics of phenological processes despite unstable agrometeorological conditions for vegetation of perennial legumes – meadow clover, alfalfa and galega orientalis. In the structure of modern forage agro-landscapes, legumes and cereal grasses in single and mixed herbage with rational adaptation of technologies are characterized by a balanced complex of nutrients, are economically cost-effective and technologically efficient for producing qualitative protein fodders. In our long-term research (2008-2019), models of biophenological parameters of possible and practical productivity of perennial agrophytocenoses were established. The hydrothermal ratio (GTR) of growing seasons in only three years of the period was lower than 1.5, indicating favorable factors for the development and formation of agrophytocenosis feed productivity in the Middle Preduralie. The parameters for the model of formation of high-yielding agrophytocenoses of meadow clover have been developed and scientifically substantiated, which include the presence of 3-4 shortened shoots and 8-10 leaves before overwintering, at least 75 plants of meadow clover per square meter after overwintering. Directions of adaptive intensification of sowing traditional fodder grasses allow the most complete use of agroclimatic and agrobiological resources of the Middle Preduralie. It has been determined that galega orientalis provides a high agrotechnological effect in both single and mixed sowings with perennial cereal grasses with the optimal ratio of herbaceous components: 80% of galega and 40% of the cereal component. Thus, 11-year research on herbal agrophytocenoses in the Middle Preduralie allows, based on models of adaptive intensification of field fodder production, recommending modern practice with different levels of economic and technological efficiency, some rational methods of stable productivity in the interval of 4-8 tons of dry mass and concentration of exchange energy 9.3-9.7 MJ/ha.

Keywords: *climatic and meteorological factors, agrophytocenosis, phenological phases, Trifolium pratense, Medicago sativa, Galega orientalis, Middle Preduralie.*

SEEDING QUALITIES AND YIELD PROPERTIES OF SUDAN GRASS DEPENDING ON THE SEED FRACTION

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Abstract

Annual forage grasses are highly important for providing animals with forage. Sudan grass is a valuable crop for the production of green forage, hay and silage. The green mass, both in the pasture and mowed, is well eaten by all types of livestock. Sudan grass is highly productive and drought resistance. In 2017-2019, studies were carried out to develop recommendations for the preparation of Sudan grass seeds for sowing, as, under present-day conditions, the increased requirements were imposed on the seed quality. Using an aerodynamic separator, we divided the seeds of Voronezhskaya 24 variety by their unit weight into five fractions and studied their seeding and yield properties. According to the results of the research conducted, the seeds with the highest unit weight had the highest germinative energy (6-7% higher than the check). Laboratory and field germination ability of the third fraction seeds was also the highest and amounted to 92.4% and 83%, while in control seeds – to 85.8% and 78% respectively. By the analysis of variance results, we can conclude that seeds fractioning exerts substantial influence on Sudan grass seeds germinative energy and germination ability at the level of significance of 0.05. The highest level of green mass yield was noted in plants of the second and third fractions (40.5 t / ha⁻¹ and 37.9 t / ha⁻¹ respectively for two mowings), thus significantly exceeding the check, the yield of which was 36.0 t / ha⁻¹.

Keywords: *selection, seeds, green mass yield, breed.*

FODDER PRODUCTIVITY OF A PERSPECTIVE VARIETY SUDANIAN GRASS CREATED BY THE VORONEZH STATE AGRARIAN UNIVERSITY (RUSSIA)

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Abstract

The article presents the results of breeding work to create promising varieties of Sudanese grass at the Voronezh State Agrarian University. Annual forage grasses are of great importance in creating a solid fodder base for livestock. Sudan grass is characterized by high resistance to drought, and therefore is of great importance in the zone of unstable humidity. The culture has good fodder qualities and high productivity. In recent years a collection of sample varieties has been studied and parental forms with important economic and biological characteristics have been selected. As a result of the research a promising variety was selected, and it is planned to be transferred to the state variety test. In 2017-2019 a promising variety of Sudanese grass was tested in comparison with the zoned standard Voronezh 24 on forest-steppe in the Central Black Earth Region. It was noted that it is characterized by a more intensive development at the beginning of growth (it entered the bush formation phase faster than the control variety by 4 days, panicle formation – by 8 days), higher bushiness (7,4 pcs/plant with the Voronezh 24 - 6.0), by formation of thinner stems (stem diameter 0.7 mm) and long well-developed leaves, indicating a better quality of feed, as well as by a higher yield of green mass, which was 406 centners per hectare for two mowings, which is 36 centners per hectare higher than the standard. The sugar content in the green mass ranges from 11 to 11.9%.

Key words: *Sudan grass, variety, breeding material, productivity, green mass, seeds.*

IMPACT OF SALINITY ON MORPHOLOGICAL, ANATOMICAL AND BIO-HISTOCHEMICAL CHARACTERISTICS OF TWO CULTIVARS OF OLIVE GROWN IN ALJOUF REGION, SAUDI ARABIA

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Abstract

The salt tolerance of two olive cultivars (Arbequina and Nepali) from the Aljouf region in Saudi Arabia was studied. Different concentrations of sodium chloride (0.1 g L⁻¹, 0.2 g L⁻¹ and 0.4 g L⁻¹) were tested on the morphological, anatomical characterization of the cultivars evaluated. An enlarged cuticle was observed and the number of trichomes was increased under salinity in Arbequina. No significant anatomical changes were observed in the Nepalese under salinity. The protein content showed different patterns of changes in the two cultivars. Both cultivars showed the same pattern of variation in lipid content and the most important was the dramatic reduction in lipid content in the Nepalese under the highest level of salt. The morphological and anatomical changes of two cultivars were discussed in terms of tolerance and sensitivity to salinity. In conclusion, morphological, anatomical and bio-histochemical characteristics of the evaluated olive cultivars indicate that Nepali is more resistant to salinity than Arbequina. The reduction in photosynthetic pigments content was more pronounced in Arbequina than in Nepali under the highest levels of salinity. Moreover, Arbequina responded to salinity by increasing the number of trichomes and induction of cutin in epidermal cells, however, Nepali responded by increasing trichomes number and salt gland formation. Further study clarifying the metabolomic profiling of both cultivars under salinity stress is required to have a holistic picture regarding the response of both cultivars to salinity stress.

Key words: *Arbequina, Nepalese, morphology, chlorophyll, salt tolerance.*

FRUIT QUALITY OF PLUM (*PRUNUS DOMESTICA* L.) CULTIVARS ‘ČAČANSKA LEPOTICA’ AND ‘EMPRESS’ AFTER COLD STORAGE

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Abstract

In order to respond to consumers' requirements, it is necessary to supply the market with high quality plum fruit. As the quality of the fruit starts to change immediately after harvest, cold storage is applied in order to maintain fruit characteristics, determined mainly in orchards. Since fruit quality and storage potential depend on cultivar, the aim of this research was to analyze and compare quality-related properties of ‘Čačanska Lepotica’ and ‘Empress’ before and after cold storage. Although examined cultivars have different ripening time, they are primarily grown for fresh consumption. Thus, all analyses were performed at harvest and after 28 days of cold storage (0–2 °C, 90–95% relative humidity), followed by a shelf life of three days at 20 °C. Fruit firmness, weight loss, susceptibility to *Monilinia* spp., soluble solids content, titratable acidity, antioxidant capacity, the concentrations of total phenolics, flavonoids and anthocyanins were monitored. After cold storage and subsequent shelf life, an increase in soluble solids content, antioxidant capacity, total phenolics and flavonoids were observed in both cultivars. Significant differences between fresh and stored plums were found in terms of fruit firmness. Fruit of ‘Čačanska Lepotica’ had higher content of soluble solids and anthocyanins and it was firmer in both analyses' dates compared to fruit of ‘Empress’. However, its fruit was more susceptible to *Monilinia* spp. and had significantly higher weight loss than ‘Empress’ fruit.

Keywords: *Storage, Fruit firmness, Weight loss, Bioactive compounds.*

IMPACT OF FOLIAR APPLICATION 'STOPIT' ON FRUIT QUALITY AND STORAGE OF 'GRANNY SMITH' APPLE (*Malus × domestica* Borkh.)

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Abstract

The paper presents the two-year results (2018–2019) of foliar product 'Stopit' application on pomological traits and storage of the apple cultivar 'Granny Smith'. Foliar treatments in apple orchards were performed four times (on June 7th, July 2nd, July 20th, August 15th – in 2018; June 14th, July 5th, July 26th, August 16th – in 2019) during vegetation, that is, from the beginning of June until middle of August. At harvest as well as after storage of fruits (120 days) in a cooler at normal atmospheric pressure, fruit morphometric traits, firmness and soluble solids content of the cultivar 'Granny Smith' and its control were studied comparatively. Analysis of the obtained results pointed to a statistically significant impact of storage period (except the soluble solids content), genotype (except fruit width) and agroecological conditions in the period of study as well as interaction effect of all variability factors on tested parameters. Values of the fruit mass ranged from 157.28 to 202.56 g, width from 60.11 to 71.72 mm, height from 71.30 to 80.03 mm and the content of soluble solids from 11.13 to 14.41 °Brix. Application of foliar product 'Stopit' containing calcium (Ca) in the form of calcium chloride (CaCl₂) conditioned a more favorable effect on pomological traits of the control variant of cv 'Granny Smith', whereas during the study period, higher values were found in the first year. From the economic perspective of apple production, values of the fruit firmness as one of the most important parameters of fruit quality were lower after taking the fruits out of the cooler although the values in each variant were higher compared to control.

Keywords: *Apple, Storage, Fruit quality.*

INFLUENCE OF GIBBERALLIC ACID ON THE GROWTH OF WHITE CLOVER SEEDLINGS

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Abstract

Seed germination is a critical stage in the life of each plant, and it greatly influences on the success in the establishment of the crop, and hence their productivity. The aim of this study was to analyze the effect of different concentrations of gibberallic acid, as a growth stimulator, on the growth of roots, stems and seedlings mass of white clover. The laboratory experiment was performed January 2020 in Čačak with seed of white clover cultivar Rivendel (Denmark cultivar). Several treatments were applied with different concentrations of gibberellic acid: control; 0.25; 0.50; 0.75; 1.0; 1.5 mmol L⁻¹. Treatments were carried out between filter papers in petri dishes using 4 mL of solution. After 12 hours of treatment, the seeds were rinsed with distilled water on filter paper and set to germination in a germination chamber according to the ISTA method with four repetitions, one hundred seeds each. After germination, measurements of the length of the root and stem of the seedlings were performed by a ruler, and the seedling mass was determined on the analytical balance. The obtained results indicated that presowing treatments with gibberallic acid did not affect the root length of white clover seedlings, which average length was 5.2 mm. Treatment with 1.5% solution of gibberallic acid had a significant positive effect on the stem length in relation to the control variant. Treatment with gibberallic acid at a concentration of 0.5% significantly increased the seedling weight. The average stem length of seedlings was 27.5 mm, and the average seedling weight was 0.00434 g.

Key words: *gibberellic acid, pre-sowing treatments, white clover.*

CALCIUM CARBONATE CONTENT IN THE SOIL OF NISAVA DISTRICT IN SERBIA

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Abstract

Calcium is one of the most abundant elements in the lithosphere and the fifth most abundant element in the soil. It has a great impact on plants and affects the structure and pH value of the soil, and calcium deficiency in the soil causes an increase in soil acidity (decrease in soil pH). Plants need calcium for development. Calcium available to plants is formed after decomposition, most often caused by carbon dioxide (CO₂). The measure that is recommended in case of calcium deficiency in the soil is calcification. Carbonates can also be harmful; in the soil of an alkaline reaction and with a high content of lime, it reduces the absorption (availability) of phosphorus (P) and most microelements. The objective of this paper was to examine the abundance of soil with easily accessible forms of calcium (CaCO₃, %-calcium carbonate or calcite) in the territory of Nisava District (Southern and Eastern Serbia) in 2016, which covers an area of 2.729 km². The total number of samples was 2.013 from 357 agricultural farms. The CaCO₃ content in soil samples was determined with a calcimeter in accordance with the method of Scheibler. The obtained data were processed in the computer program IBM SPSS Statistic – trial version 20. The analysis showed that the soils in this area were insufficiently supplied with calcium carbonate. As many as 84.5% of the samples fall into the class of soil insufficiently provided with calcium, with a calcium carbonate percentage between 0-5%, while only 1.5% of the total number of samples can be classified as soil abundant in calcium carbonate.

Key words: *calcium, calcium carbonate, analysis, soil, Nis.*

VARIETY AND QUANTITY OF SEEDS AS FACTORS AFFECTING YIELD AND YIELD COMPONENTS OF WINTER TRITICALE

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Abstract

This paper analyzes the influence of different quantities of seeds (300 and 360 kg ha⁻¹) on the yield and yield components in 5 varieties of winter tricale (Odissey, Kg-20, Triumph, Rtanj and Tango) grown in the northern part of Montenegro during two growing seasons (2010/11 and 2011/12) on river alluvium soil type. During the trial, in both years of testing, all varieties were fertilized with the equal amount of NPK fertilizer in a ratio of 90:80:80. It was found that all of the three individual factors: variety, quantity of seeds and climatic conditions in the years of testing had a significant influence on the yield and other observed parameters. The test results showed that, on average, for all cultivars and both applied quantities of seeds, the highest yield was obtained with the Tango variety, while the lowest with the Kg-20 variety. It was also observed that the hectolitre weight in the tested tricale varieties were higher when applying a higher quantity of seeds. The application of a smaller quantity of seeds led to a significant increase in the 1000 grain mass in all cultivated varieties compared to the application of a higher quantity of seeds and it was also higher in the second study year.

Keywords: *Triticale, variety, quantity of seeds, fertility.*

RESPONSE OF SOME WINTER WHEAT CULTIVARS TO NITROGEN TOPDRESSING AND SOWING DENSITY

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Abstract

The aim of study was to assess the effects of interaction between nitrogen fertilization and sowing densities on grain yield of modern wheat cultivars. A two-year study of the wheat response to increasing doses of nitrogen fertilization and different sowing densities was carried out under rainfed conditions in the experimental field of the Institute of Field and Vegetable Crops, Novi Sad, Serbia. The experiment consisted of four nitrogen fertilization treatments (F): 0, 50, 100 and 150 kg N ha⁻¹; four winter wheat cultivars (C): NS 40S, NS Azra, NS Ilina and NS Petrija, and four sowing densities (D): 300, 500, 700 and 900 viable seeds m⁻². Analysis of variance showed statistically significant effects of cultivars and sowing densities, as well as interactions F×C, C×D and F×C×D on total variability of grain yield. Contribution of cultivars to the total sum of squares was highest, showing different response to various N-fertilization and sowing density treatments. On average, grain yield varied between cultivars from 9.82 (NS Petrija) to 10.74 t ha⁻¹ (NS 40S). The highest grain yield was achieved with cultivar NS 40S under conditions of 100 kg N ha⁻¹ and 900 viable seeds m⁻². However, in most cases differences between 500, 700 and 900 viable seeds m⁻² were not statistically significant.

Keywords: *Winter wheat, yield, nitrogen topdressing, sowing density.*

THE SYLLEPTIC SHOOTS OF APRICOT (*PRUNUS ARMENIACA* L.) - FLOWERING PHENOPHASE AND PROPERTIES OF FRUITS

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Abstract

The growth of young shoots of apricot during the growing season takes place through two or three stages of growth. During the vegetation sylleptic shoots can develop. Their number and length are conditioned by the growing conditions, cultivar and applied growing technology. During 2018 impact of heading cut of shoots within early summer apricot pruning on sylleptic shoots development was investigated. The research included three cultivars ('Goldrich', 'Roxana', and 'Hungarian Best') grafted on Myrobalan seedlings (*Prunus cerasifera* Ehrh.). The cutting back of shoots was done in time of their intensive growth in the first half of vegetation (10th of June). In the following 2019, the reaction to pruning was studied by determining the number and length of developed sylleptic shoots. Also, flowering time and the most important properties of fruits on sylleptic shoots in relation to other types of bearing wood in the same canopy were investigated. The results showed that the summer apricot pruning resulted in the development of sylleptic shoots in all investigated cultivars. The number of sylleptic shoots per one-year old shoot varied from 1.90 ('Hungarian Best') to 4.05 ('Roxana'), which is a significantly higher number than when they developed spontaneously (0.10 on average). The average length of spontaneously developed sylleptic shoots was 14.60 cm, while the average length of sylleptic shoots developed after heading cut was 19.17 cm. Flowering phenophase on sylleptic shoots in relation to other types of bearing wood in the same canopy was delayed 2-3 days and lasted one day longer. The weight of fruits developed on sylleptic shoots ranged between 55.24 g ('Hungarian Best') and 62.35 g ('Goldrich') and was on average 11.30% lower in comparison with weight of fruits developed on other types of bearing wood in the same canopy.

Key words: *apricot, heading cut, start and duration of flowering, fruit weight.*

THE EFFECT OF FERTILIZATION AND FRUIT ORDER ON STRAWBERRY FRUIT QUALITY

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Abstract

Fertilization is an important cultural practice in modern strawberry production, including the use of different types of fertilizer. The present research is aimed to evaluate the effect of fertilizer type and order in the truss on the fruit quality of strawberry cultivar 'Clery'. Fruit quality (mass, dimensions, shape index, firmness, soluble solids and total phenols) was monitored in three fertilizer treatments (biofertilizer, the combination of bio- and mineral fertilizer and mineral fertilizer) and four fruit positions in the truss (primary, secondary, tertiary and quaternary). Application of mineral fertilizer resulted in a significant increase in fruit firmness (10.4 N) while the use of biofertilizers containing bacteria of the genus *Bacillus* enabled fruits with significantly higher total phenolic content (276.6 mg GA/100 g fw) with the positive effect also exerted in secondary positioned fruits (486.7mg GA/100 g fw). Differences in quality traits were greater among different fruit positions, compared to fertilizer treatments although primary fruits were characterized by the highest values of mass and dimensions. Tertiary positioned fruits had the highest soluble solids content (11.7%) that did not significantly differ from the fourth batch of strawberry fruits (11.1%). Overall, the result of this study suggests that fruits at a lower position in the truss have better organoleptic composition while fruits on higher positions have better physical properties. Biofertilizers used in combination with mineral fertilizers have the potential to increase physical strawberry properties and the use of biofertilizers as supplements to mineral fertilizers can be considered an appropriate practice to ensure safe strawberry fruit production and help overcome environmental problems caused by the overuse of mineral fertilizers.

Keywords: *Strawberry, Biofertilizer, Mineral Fertilizers, Fruit order, Fruit Quality.*

Ca:P RATIO AND CONTENT OF Ca AND P IN SOME ANNUAL LEGUMES-OAT MIXTURES DEPENDING ON SEEDING RATE AND STAGE OF GROWTH

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Abstract

Calcium and phosphorus are particularly important for animal health. The dietary levels of Ca and P should be balanced to increase their availability and utilization. The research was conducted at Institute for forage crops Kruševac in 2015-2016 to determine the effects of seeding rates in mixtures of pea : oat and common vetch : oat and cutting stages on the Ca and P content, as well as Ca : P ratio. The experiment was performed using five different mixture rates of pea and oat crops, five different mixture rates of common vetch and oat crops and three different cutting stages (beginning of pea and common vetch flowering – 10% of flowering, forming the first pods on 2/3 pea and common vetch plants and forming green seeds in 2/3 pods). Results of investigation showed that Ca content was the highest at the forming the first pods on 2/3 pea and common vetch plants, while phosphorus content increased from 2.70 to 3.40 g kg⁻¹ with common vetch growth and development and from 2.57 to 3.10 g kg⁻¹ with pea growth and development. Pure sown common vetch and pea were characterized by the highest average Ca and P content. Ca : P ratio decreased with plant growth and development in pea : oat mixtures, as well as in common vetch : oat mixtures. The highest Ca : P ratio was recorded in pure sown common vetch and pure sown pea, whereas the lowest Ca : P ratio was recorded in pure sown oat.

Keywords: *calcium, phosphorus, Ca : P ratio, pea, common vetch, oat.*

STABILITY OF WHEAT GENOTYPES AND QUALITY TRAITS IN DIFFERENT AGROECOLOGICAL CONDITIONS

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Abstract

In the breeding program of bread wheat, in the last years, a substantial focus has been directed towards the creation of genotypes that, in addition to high yields, have a high grain quality. Also, an increased stability of quality in different environmental conditions is one of the main tasks of selection at the global level. The goal of this research is the investigation of stability expression regarding sedimentation volume and wet gluten content for 14 genotypes of winter bread wheat using AMMI model. Field experiment was conducted at three localities: Centre for Small Grains in Kragujevac, Institute for Forage Crops in Kruševac and Agroiustitute in Sombor, Serbia. Analysis of the variance showed that all sources of variation (G, E, G × E) showed statistical significance, where the environmental effect represents statistically the most significant source of variability in expression on sedimentation volume (40.64%) and genotype in expression of wet gluten content (50.42%). It has been established that the most stable genotypes for sedimentation volume were KG-244/4 and KG-199/4, and for wet gluten content genotypes KG-307/4 and KG-52/3.

Key words: *wheat, stability, AMMI analysis, sedimentation volume, wet gluten content.*

COULD COLD INDUCED GENES BE USED AS A TOOL FOR DETERMINING TOLERANCE TO LOW TEMPERATURES IN DIFFERENT MAIZE LINES?

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Abstract

A large number of strategies in crop production today is focussed on ensuring a decrease in yield loss occurring as a result of the increasing temperatures and drought arising during late spring and summer, which are only some of the consequences of climate change. One of those strategies is earlier sowing, during the colder months in early spring, which means that finding methods that quickly and accurately estimate low temperature tolerance of different crops, including maize, is becoming increasingly important. Our idea was to use the expression of *Zea mays sp.* cold induced genes (*ZmCOI*) for this purpose, and to see if there is a significant correlation between the quantities of certain *ZmCOI* mRNA and low temperature tolerance. This was done through an experiment that included growing several maize lines known from breeders experience to be sensitive or tolerant to cold, under optimal and low temperatures, 22° C and 6° C, respectively. Samples (plant leaves) were taken during the V₄ growth stage, at different time points during the treatment (6^h and 24^h) and used for RNA extraction, cDNA synthesis and qPCR expression analysis for the selected genes (*ZmDREB2A*, *ZmERF3*, *ZmACA1*). Preliminary results showed changes in the expression of these genes between chosen sensitive and tolerant inbred lines. These results provide a good basis for further studies with more cold induced genes and inbred lines that will hopefully confirm their effectiveness as a tool for determination of tolerance to low temperatures.

Key words: *Maize, Cold stress, Relative gene expression, Cold induced genes.*

MARKER ASSISTED SELECTION FOR β -CAROTENE RICH MAIZE: TWO-LEVEL SELECTION PROCEDURE IN BC₂ GENERATION

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Abstract

This paper is a part of the breeding program conducted at the Maize Research Institute "Zemun Polje" (MRI), with the aim to convert the standard maize to β -carotene rich genotypes adapted to temperate regions using the marker assisted selection. When SSR marker specific to the *crtRBI* gene has been tested on parental lines, distinct polymorphism was observed between the donor and recurrent parents. The same marker has also been validated in BC₁ generation when heterozygous individuals were clearly distinguishable from the homozygous dominants. The results presented herein refer to two-level selection procedure in BC₂ generation. First, BC₂ plants were analyzed with *crtRBI*-specific molecular marker to separate heterozygotes from dominant homozygotes. Percentage of heterozygous plants was approximately 50%, which was in accordance with the expected Mendelian ratio of 1:1. Second, the selected heterozygotes were screened with 30 polymorphic SSR markers distributed throughout the maize genome to identify genotypes with the highest recovery of recurrent parent's genome (RPG). The RPG values among three analyzed parental lines and their respective progenies ranged from 85-99%. For each line separately, RPG values were: 86-97% (RP₁), 90-95% (RP₂) and 85-99% (RP₃). Plants with RPG above 95% were selfed to produce BC₂F₂ generation in which homozygous recessive individuals would be identified. Those genotypes will be subjected to biochemical and phenotypic evaluation to confirm their nutritional and agronomical superiority. Finally, these β -carotene enriched lines, as well as the resulting improved hybrids, can be used in the biofortification programs.

Keywords: *β -carotene, crtRBI gene, maize, marker assisted selection.*

EFFECTS OF IBA CONCENTRATION ON PROPAGATION OF CHIMONANTHUS PRAECOX (L.) LINK BY SOFTWOOD CUTTINGS

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Abstract

This deciduous large shrub has very abundant yellow, strongly scented, flowers produced during winter. For that reason, it is valuable species for landscape use as an ornamental plant. Its vegetative propagation is usually done by spring cuttings or layering. The aim of this study was to determinate the optimal auxine concentration for rooting of softwood cuttings of selected elite genotype of *C. praecox* growing in the Belgrade area. Nodal softwood cuttings were used and treated with 25 ppm, 50 ppm or 100 ppm solution of IBA during 24 h, before sticking in sand. Six weeks after sticking, cutting were taken from substrate, examined and their state (callused, rooted or without change) was recorded. Rooting percentage was low, not exceeding 20%, but the number of callused cutting was higher than 50% in all treatments and control. Cuttings were returned to the rooting substrate for additional 6 weeks and after that the rooting percentage as well as number and length of primary and secondary roots were determined. Results obtained in a control treatment without IBA were poor (only 15.8% rooted cuttings), indicating that auxine treatment was necessary in a propagation of this species. Cuttings treated with 50 ppm IBA had the highest rooting percentage (34.7%), but the highest number of primary roots and the longest roots developed on cuttings treated with 100 ppm IBA. Taking into account that rooting of softwood cuttings can be strongly influenced by time of their collection, the obtained results could be improved by additional research.

Key words: *wintersweet, vegetative propagation, cuttings, greenwood, auxine.*

THE INFLUENCE OF DIFFERENT SEED TREATMENTS ON DORMANCY BREAKING AND GERMINATION OF LIRIODENDRON TULIPIFERA L.

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Abstract

Liriodendron tulipifera is a large, deciduous tree up to 50 m tall. It is admired for its tulip-like, melliferous flowers that bloom in spring. Tulip tree is also a good shade tree and its wood is used for furniture and general lumber. Recently, it became very popular as an ornamental tree in Serbia and we decided to research a possibility of generative propagation of selected two elite trees growing in the Belgrade area. During the experiment, the seeds collected in October were cold stratified in sand or in bags without a substrate, for 2, 3 or 4 months. Obtained results showed that quality of seeds was low with a small number of viable seeds. Germination rate did not exceed 16%, but the real germination rate (calculated as a percentage of sound seeds that germinate) was considerably higher, reaching 82.5%. Besides, considerable difference in a response to stratification method between seeds collected from different trees was recorded. Seeds collected from one of the mother trees did not show significant difference in real germination rate after 2 or 3 months stratification in sand (66.5% and 64.6%, respectively), but seeds collected from the other tree had higher real germination rate after being stratified for 3 months in sand (82.5%) than after 2 months of stratification in sand (only 18.8%). Although genotype strongly influenced obtained results, we can conclude that 3 months stratification in sand showed overall the best results, but seed viability should be tested before its use for propagation.

Key words: *tulip tree, seed dormancy, cold stratification, generative propagation.*

EFFECTS OF STORAGE LENGTH ON ERYTHROSTEMON GILLIESII (HOOK.) KLOTZSCH SEED GERMINATION

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Abstract

Erythrostemon gilliesii is evergreen shrub, deciduous in colder climates growing 1-4 m tall. It is native in South America, but is now widely grown because of its decorative yellow flowers with long red stamens which bloom in summer. *E. gilliesii* is well adapted to dry conditions, growing easily in well drained soils in a full sun. Common propagation method of this species is by seed. The aim of this study was to investigate the effect of storage period of 10 years on germination and seed coat dormancy. After collection, part of the seeds was placed on germination, and the rest were stored in a room temperature, in dry conditions. After 10 years, 3 different treatments were conducted: soaking seeds in sulfuric acid at 96% for 15 minutes, mechanical scarification and soaking seed in water for 24 h (control). Germination of seeds immediately after collection (95%) was similar to germination in control after 10 years (98%). However, the germination energy after storage was considerably lower, only 23.5% compared to 82% recorded in a time of seed collection. The mechanical scarification and sulfuric acid treatment were not favourable for germination (76.5% and 85%, respectively), indicating that the additional pretreatments for breaking shallow seed coat dormancy were not required for *E. gilliesii*. The obtained results may also have ecological significance because *E. gilliesii* is capable of maintain high germination rate over a long period of time.

Key words: *Desert bird of paradise, seed storage period, sulfuric acid, coat dormancy, scarification.*

PROPAGATION OF SPIRAEA × VANHOUTTEI (BRIOT) CARRIÈRE BY SOFTWOOD, SEMI-HARDWOOD AND HARDWOOD CUTTINGS

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Abstract

Van Houtte's spiraea is low maintenance ornamental plant that is considered highly resistant to urban pollution, and it also tolerates moderate drought. The bridalwreath spiraea can be propagated by cuttings, but there is no sufficient data about expected rooting rate for different cutting types. Therefore, we decided to investigate rooting success of softwood, semi-hardwood and hardwood cuttings of bridalwreath spirea thus establishing the optimal method for its vegetative propagation. The group of *S. × vanhouttei* vigorous and healthy shrubs, 8 years old was selected as cuttings source. Green cuttings were taken in July, semi-hardwood cuttings were taken in September, and both cutting types were treated with dust preparation of 0.1% IBA before sticking in sand. Hardwood cuttings were taken in January, the base of cuttings was wounded 1 cm deep, and also treated with 0.1% IBA. Obtained results showed that there were considerable differences in a rooting of these cutting types. The best results were obtained using hardwood cuttings (93.3% rooted cuttings) followed by semi-hardwood cuttings (85.3% rooted cuttings). However, there was no statistically significant difference between cuttings treated with 0.1% IBA and the control treatment; rooting percentage was slightly lower in a control (91% rooted hardwood cuttings, 83% rooted semi-hardwood cuttings), indicating that auxine treatment could be omitted during vegetative propagation of *S. × vanhouttei*.

Key words: *Van Houtte's spiraea, hardwood cuttings, semi-hardwood cuttings, green cuttings, vegetative propagation.*

CHANGES IN PROTEIN CONTENT AND QUALITY OF WINTER WHEAT UNDER CONDITIONS OF PANNONIAN PLAIN

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Abstract

During the past century, wheat breeding activities were mainly related to grain yield increase, while less attention was paid to the improvement of wheat grain yield quality. Therefore, the aim of this study was to analyze the breeding progress in protein and wet gluten content and sedimentation value of winter wheat cultivars released in Serbia and surrounding countries during the past 100 years. In order to investigate variation in protein content and quality traits, field experiment was conducted during two growing seasons at the field of Institute of Field and Vegetable crops, Novi Sad. After the harvest, grain nitrogen content was determined according to the Kjeldahl method, wet gluten content was determined by Glutomatic 2020, while the sedimentation value was determined according to AACC (2000) method 56-62.01 after samples milling. Changes in quality traits of wheat cultivars from different eras were presented as bi-linear or tri-linear function with year of cultivar release. The grain protein content in the grain showed a bilinear trend of decline with year of cultivars release. Protein content increased with higher rate until 1980s, and after inflection point reduction was smaller. Relationship between wet gluten content and year of cultivar release was negative during the first period, while in the second period changes were not related with year of cultivar release. On the other hand, changes in sedimentation value had a significant tri-linear trend with year of cultivar release. The first and third slope showed genetic progress in sedimentation value, while changes during the second period were insignificant. In conclusion, breeding progress in Pannonian wheat resulted in protein and wet gluten decline. Nevertheless, increase in sedimentation value clearly indicates that protein quality has been improved during the past 100 years.

Keywords: *breeding progress, protein, sedimentation value, wet gluten, wheat.*

THE INFLUENCE OF BIO-FERTILIZER ON THE UTILIZATION EFFICIENCY OF MACRO-NUTRIENTS IN PROSO MILLET

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Abstract

Bio-fertilizer can affect nutrient uptake by plant, using microorganisms to enhance their availability from soil. Once the nutrient is absorbed, measuring its utilization efficiency (NUtE) is directly related to grain yield and therefore important in sustainable agriculture. This research was aimed to investigate influence of bio-fertilizer on Mg, Ca, P and S concentration in proso millet biomass, as well as utilization of these macro-elements for yield potential. The field experiment was performed during 2018. One part of seeds was treated with bio-fertilizer Coveron (containing *Glomus sp.* and *Trichoderma*) while the other part, control one, was sown without treatment. Macro-elements concentration was measured by inductively coupled plasma-optical emission spectrometry (ICP-OES) and data were analysed using one-way ANOVA. Obtained grain yield was higher in no-treated millet, while treatment with Coveron expressed positive impact on the biomass yield. Concerning macro-elements concentration in biomass, accumulation of all nutrients was greater in control millet (2.91, 3.30, 2.66 and 1.36 g kg⁻¹ for Ca, Mg, P and S, respectively). However, values of NUtE (for examined elements) were higher in proso treated with Coveron and consequently highlighted better utilization efficiency of these elements in treated millet in comparison with no-treated. Irrespective the fact that bio-fertilizer influenced lower nutrients uptake by proso millet, calculated NUtE distinguished this treatment as more successful in nutrient utilization efficiency for grain yield. Therefore, further investigations will be conducted to support impact of bio-fertilizer Coveron on utilization efficiency of Mg, Ca, P and S for sustainable proso grain production.

Keywords: NUtE, Magnesium, Calcium, Phosphorus, Sulfur.

METABOLIC ENGINEERING IN CHICORY BY CRISPR/CAS9 EDITING

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Abstract

Chicory (*Cichorium intybus* L.) is a valuable crop grown mostly in northern France, Belgium and the Netherlands, whose roots, leaves and etiolated shoots are used as vegetable, coffee replacement and remedy for several conditions including inflammation. Roots of chicory are an important source of inulin, a prebiotic fiber and a sweetener. Chicory also contains bioactive terpene compounds that protect the plant against herbivores, but are also responsible for medicinal properties of the plant, as they have anti-microbial, anti-cancer and anti-inflammatory activity. Biosynthesis of plant bioactive metabolites can be modified using new plant breeding techniques, especially new gene editing techniques like CRISPR/Cas9 to improve their health-promoting qualities. Chicory was transformed with *Agrobacterium tumefaciens* carrying CRISPR/Cas9 constructs to knock-out expression of key genes in the sesquiterpene biosynthesis pathway. Regenerated plants were selected on media with kanamycin and further tested by PCR for the presence of transgenes. Obtained plants were also tested for mutations in target genes, by PCR with primers surrounding the mutation site detecting larger indels and by Sanger sequencing detecting smaller indels. Further analysis was performed detecting heteroduplex DNA fragments as a result of either hetero- or homozygous mutation events.

Keywords: *chicory, terpenes, CRISPR/Cas9, Agrobacterium tumefaciens.*

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INFLUENCE OF *CANNABIS SATIVA* L. ON GUAIACOL PEROXIDASE ACTIVITY IN *SORGHUM HALEPENSE* (L.) PERS.

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Abstract

Allelopathy is ability of certain plant species to release secondary metabolites in external midstream, and is used to disrupt normal development of other plant species. Weed yield reductions can be as high as 34%. The aim of this study was to determine allelopathic effect of *Cannabis sativa* L. extract on the activity of guaiacol peroxidase in leaves of *Sorghum halepense* (L.) Pers. A milled dry plant material of *C. sativa* collected at the ripening stage was used in the experiment. Extract of *C. sativa* was obtained by classical extraction and applied at concentrations of 100%, 50%, 25% and 10% as opposed to the control in which plants were not treated. The activity of guaiacol peroxidase was determined according to Morkunas and Gmerek (2007). The absorbance was recorded at 436 nm. The activity of guaiacol peroxidase was expressed in U/g of fresh weight (U/g FW). Applied extracts of *C. sativa* led to some changes in the activity of guaiacol peroxidase in leaves of *S. halepense*. Applied concentrations indicate a decrease in monitored activity after 6 h and 24 h. Increasing concentration of applied extract decreased activity of guaiacol peroxidase. In the control plants activity was 10.91 U/g FW while in variant with application of 100% of the extract it was 7.08 U/g FW. An experiment variant with 50% extract activity was 7.07 U/g FW, where a 25% extract value was 8.56 U/g FW and with a 10% extract value was 9.38 U/g FW. After 24 h, guaiacol peroxidase activity in control plants was 9.18 U/g FW, in variant with 100% extract it was 7.74 U/g FW, with 50% extract it was 5.56 U/g FW, with 25% extract it was 9.58 U/g FW and with 10% extract it was 10.53 U/g FW. The *C. sativa* applied extract decrease guaiacol peroxidase activity after 6h and 24h. Observed changes indicate the presence of stress in treated plants of *S. halepense*.

Key words: *Cannabis sativa* L., *Sorghum halepense* (L.) Pers., allelopathy, guaiacol peroxidase.

DYNAMIC OF TOTAL PHENOLIC CONTENT *cv* CABERNET SAUVIGNON DURING RIPENING AND IMPACT ON ANTIOXIDANT CAPACITY OF WINE

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Abstract

In this study, the impact of ripening phenophases on the total phenolic content in wines and their antioxidant capacity was studied. Grapes were harvested in three different stages of maturity: *v*eraison, optimal enological maturity and overripeness, which originated from vineyards belonging to experimental field "RADMILOVAC" of the Faculty of Agriculture in Zemun, University of Belgrade (Serbia). After grapes crashing and destemming, the samples of crushed grapes sulfited with 10 g of K₂S₂O₅ per 100 kg and yeast strain *Saccharomyces cerevisiae* in the amount of 20 g/hl (BDX, Lallemand, Canada) was inoculated. Alcohol fermentation with maceration lasted 21 day at temperature of 25±3⁰C using the "pigeage" system (mechanically punching down). After that pomace was separated and obtained wine samples were bottled and stored until analyses. Total phenolic content in wine samples was determined by the Folin–Ciocalteu's (FC) method using gallic acid as a standard. According to this method, the highest phenolic content was for *v*eraison sample (1385.0 mg GAE/l), then for optimal enological maturity sample (1325.0 mg GAE/l), and the lowest content was for overripeness sample (1070.0 mg GAE/l). Also, anti-DPPH radical activity and antioxidant capacity were analysed using FRAP and TEAC methods. The results of these antioxidant methods showed that higher total phenolic content led to better antioxidant capacity of wine samples. A *v*eraison wine sample showed the highest antioxidant capacity which was positively correlated with their total phenolic content.

Keywords: *Total phenolic content, grape maturation, antioxidant capacity, wine.*

THE INFLUENCE OF VARIOUS SOIL TILLAGE SYSTEMS ON ENERGY CONSUMPTION IN WINTER WHEAT AND RYE PRODUCTION

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Abstract

The production of small grains can be obtained by using various soil tillage systems. Although the conventional tillage demands the highest energy inputs with respect to other systems, it is still the most commonly used tillage system in Serbia. An inadequate tillage system reduces yield and increases production costs. The paper presents the results of examining the impact of different tillage systems on energy consumption in the production of winter wheat and rye, as well as the yields obtained. The tests were performed in the vicinity of Vršac on degraded chernozem type soil, and included three tillage systems: conventional tillage system - CT, conservation tillage system - RT and the variant without tillage, i.e. direct sowing - NT. The obtained results showed that in the production of winter wheat using the conventional tillage system - CT measured the highest energy consumption which averaged 66.43 [l ha⁻¹] or 2570.84 [MJ ha⁻¹]. In the variant of direct sowing - NT, we measured significantly lower values of energy consumption compared to the conventional tillage system, on average 11.17 [l ha⁻¹] or 432.28 [MJ ha⁻¹]. By applying conservation tillage, an average of 51.41 [l ha⁻¹] and 1989.57 [MJ ha⁻¹] were spent, respectively. A similar impact of the applied tillage system on energy consumption was observed in the production of winter rye. The highest yield of winter wheat was achieved in the variant of direct sowing NT, and the lowest in the variant of conservation treatment RT, while in the production of winter rye the highest yield was achieved in the variant of conservation treatment RT, and the lowest in the variant of conventional treatment CT.

Keywords: *Tillage, Energy consumption, Yield, Wheat, Rye.*

THE PRESENCE OF FREE-LIVING NITROGEN-FIXERS IN SOILS OF STARA PLANINA MOUNTAIN IN SERBIA

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Abstract

The community structure and number of microorganisms are different in different soil types, and they represent the result of interactions between the soil type, plant species, localization of the microorganism in rhizosphere, anthropogenization and other factors. Certain microorganisms known for their ability to fix atmospheric nitrogen are also important for the development of healthy soil structure. Furthermore, they are important for the nitrogen input to soils in agroecosystem and represent economically attractive and ecologically acceptable means for reducing external inputs and improving soil quality. Soil samples were taken from pastures and meadows in the area of Stara Planina Mountain. According to its geographical and climatic conditions the area is characterized by typical hilly-mountainous regions with meadow and pasture systems for fodder production. The aim of this research was to examine quality of grasslands soil, so the parameters of soil fertility and number of free-living nitrogen-fixers from 55 locations were determined. The largest number of soil samples were characterized showed good amounts of soil organic matter, high nitrogen content and slightly acidic chemical reaction. Fjodorov agar was used for determining the number of free-living nitrogen-fixing microorganisms and their abundance ranged from 6.378 to 7.021 (log of number) per gram of absolutely dry soil.

Keywords: *free-living nitrogen-fixing microorganisms, soil, Stara Planina Mountain.*

YIELD AND NUTRITIVE VALUE OF COCKSFOOT (*DACTILYS GLOMERATA* L.) COLLECTION

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Abstract

Cocksfoot (*Dactylis glomerata* L.) is one of the most important forage perennial grasses in Europe and Serbia. It is naturally present in Serbia from lowland to mountains over 1000 m a.s.l. It has great adaptability, with high yield potential of forage, over 10tha⁻¹. If it has been cut frequently, quality of cocksfoot forage can be comparable with quality of perennial ryegrass. It has showed very high and stabile yield in mixtures with legumes, especially with alfalfa, and other grasses. Cocksfoot shows large climate tolerance in frost, shade, heat and drought resistant with good regrowth ability. Primary aim in cocksfoot forage breeding is obtaining of cultivars with high yield and quality for livestock nutrition. In this study productivity and biomass quality of 19 cocksfoot accessions was investigated, 15 breeding populations originated from the local populations collected mainly in Eastern Serbia, which passed 2 cycles of selection and 4 cultivars. They were tested in plots 5x2m, as a randomised block design, in 3 replications. Each plot was sown with seeding rate to 25 kg ha⁻¹. In the planting year plots were cut without weighing. In the next two years, two cuts were taken. The first cut was done at the beginning of heading (the first decade of May) and the second in the first decade of July. Dry matter yield in the first and second cuts were presented separately for each year. Nutritive value (crude protein, crude fat and ash) was determined by the Weende system, content of neutral detergent fiber (NDF) and acid detergent fiber (ADF) according AOAC 973.18, 1997. Forage quality was determined in two cuts, and the results were presented as two-year average values.

Keywords: *cocksfoot, dry matter yield, biomass quality, breeding populations, cultivars.*

VARIABILITY FOR KERNEL TOCOPHEROLS AMONG MAIZE INBRED LINES

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Abstract

Maize, among cereals, has the greatest content of tocopherols, which play important role in human and animal health and plant metabolism. In this study content of α , $\beta+\gamma$ and δ tocopherols was measured in 123 maize inbred lines: 74 with standard kernel type, 37 sweet corn and 12 popcorn, aimed to determine inbred lines that could be used in breeding program to improve tocopherols content. Inbred lines with standard kernel type have the highest average content of α tocopherols (14.72 $\mu\text{g/g DW}$) and sweet corn lines have the highest content of $\beta+\gamma$ tocopherols 72.81 $\mu\text{g/g DW}$. Popcorn lines have the lowest average content of all tocopherols. $\beta+\gamma$ -tocopherol had the highest level of variation (range: 30.79 to 115.65 $\mu\text{g/g}$), followed by α -tocopherol (range: 3.12 to 25.47 $\mu\text{g/g}$), and δ -tocopherol possessed moderate degree of variation (range: 0.21 to 4.27) $\mu\text{g/g}$. The content of α -tocopherol ranged from 3.41 to 25.47 $\mu\text{g/g DW}$ in inbreds with standard kernel type and from 4.17 to 19.01 DW in sweet corn inbreds and $\beta+\gamma$ tocopherol content vary from 30.79 to 105.62 $\mu\text{g/g DW}$ in inbreds with standard kernel type and from 42.56 to 115.65 $\mu\text{g/g DW}$ in sweet corn inbreds. Two sweet corn inbred lines with highest content of $\beta+\gamma$ tocopherols were identified: Gold-5 and Esteem 1-13, as well as two lines with standard kernel type with the highest content of α tocopherols TVA973 and inbred H. Inbred lines with high content of α as well as γ tocopherols may be used in breeding programs to improve nutritional value.

Keywords: *maize, nutritional quality, vitamin E, variability.*

INFLUENCE OF IBA BASED STIMULATORS AND IAA BASED BIOSTIMULATOR ON PROPAGATION OF *ROSMARINUS OFFICINALIS* L. BY CUTTINGS

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Abstract

Rosmarinus officinalis L. is a valued perennial medicinal and aromatic plant belonging to *Lamiaceae* family. Vegetative propagation of this plant by cuttings is preferable since its seed is difficult to germinate. The aim of this research was to achieve the highest number of successfully rooted cuttings of *R. officinalis* by the use of various IBA or IAA based stimulators. Prior to putting into trays filled with a mixture of peat moss and perlite, cuttings were treated with the IBA based rooting powders “Chryzotop Green 0.25” (IBA 0,25%), “Rhizopon AA” (IBA 0.5%) and “Rhizopon AA” (IBA 1%), IAA based rooting biostimulator “Slavol S” (0.1-1 mg/L of IAA) and only water (control). The experiment was performed in the laboratory conditions inside a polythene tent for plant propagation under artificial lighting and with the use of the intermittent mist-propagation system. Two evaluations (on the 15th and 30th day) of the rooting of 32 cuttings per treatment were conducted following the placement of cuttings in the trays, and the rooting rate (%) and the absolute root dry mass (mg) were recorded. The first evaluation showed the better efficacy of all IBA stimulators compared to the IAA biostimulator and control, while the second one revealed that treatments with IBA 0.5 and 1% did not differ between themselves and both were the most efficient treatments. Therefore, they could be successfully used as rooting stimulators of *R. officinalis* as the absolute root dry masses were 19.06±12.28 and 14.24±7.46 mg, while the rooting rates were 93.8 and 68.75%, respectively.

Keywords: *rosemary, vegetative propagation, IBA stimulator, IAA biostimulator.*

EXPLOITATION AND ECONOMIC PARAMETERS OF PESTICIDE APPLICATIONS IN OIL RAPESEED

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Abstract

The application of fungicides and insecticides in oilseed rape is a challenge due to the specificity of inflorescences and flowers, leaf arrangement and leaf surface. The goal of efficient and economical protection of oilseed rape means the deposit of pesticides on all parts of the plant, whether it is contact or systemic preparations. When it comes to large areas, the reaction time is significantly reduced and often there is a problem with the organization of work. Limitations in the application of pesticides are reflected in weather conditions, especially wind, temperature and humidity. For this reason, the time for efficient and economical application of pesticides is significantly less than in other crops or in herbicide treatment. With the help of the support system for automatic control of the application of pesticides, it is possible to perform the assigned job. Automatic control of pesticide application means maintaining a constant planned rate regardless of the working speed. The control system maintains the planned rate by changing the operating pressure via a proportional valve taking into account the current working speed and the current flow of the sprayer. However, the malfunction of the mentioned system can cause significant problems in terms of drastic increase in production costs due to higher consumption of plant protection products. Therefore, the economics of pesticide application and environmental protection are in question. Using precision agriculture technologies, it opens up new opportunities in analyzing the quality of pesticide applications. An analysis of exploitation and economic parameters of pesticide applications in one season of oil rapeseed production on 404 ha was performed. The costs of oil rapeseed protection amounted to more than 43 eur/ha. It was found that the sprayer had an increase from the planned rate in the range of 15% to 313% due to a malfunction. In just one treatment, the increased consumption of the chemical amounted to 122.17% on an area of 389 ha, which represented an increase in costs by € 5,832.58 or 14.86% of the total funds spent on plant protection products.

Key words: *Pesticide application, Precise agriculture, Oil rapeseed.*

FRUIT QUALITY OF PLUM CULTIVARS DEVELOPED AT THE FRUIT RESEARCH INSTITUTE IN ČAČAK, SERBIA

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Abstract

The experiment evaluated the fruit characteristics (fruit weight, length, width and thickness, and stone weight) and contents of primary metabolites (soluble solids, total sugars, invert sugars, protein, titratable acidity and pH) in the fruit of plum cultivars. Research included fruits of thirteen plum cultivars developed at the Fruit Research Institute in Čačak (Serbia). During the experimental period (2016-2018), significant differences in the parameters tested were observed among the cultivars. The fruit weight ranged from 26.9 g to 67.4 g, and stone weight from 0.89 g to 2.27 g. The fruit and stone weight were the greatest in cultivar 'Timočanka', and the lowest in cultivar 'Zlatka'. The highest value for average fruit length was obtained in 'Timočanka' (52.4 mm) and 'Čačanska Rana' (51.7 mm), fruit width in 'Timočanka' (45.1 mm) and 'Valerija' (46.2 mm), while fruit thickness was the highest in 'Valerija' (44.6 mm). In terms of primary metabolites, cultivars 'Krina' (21.8%), 'Mildora' (21.9%), 'Pozna Plava' (21.2%) and 'Valjevka' (20.9%) had the highest content of soluble solids. The highest total and invert sugar contents were determined in 'Mildora', while 'Mildora', 'Zlatka' and 'Valerija' were found to have highest content of protein. In contrast, the highest values for titratable acidity and pH value were obtained in 'Čačanska Lepotica', and the lowest in 'Mildora' and 'Nada'.

Keywords: *Prunus domestica L.*, fruit dimensions, primary metabolites.

INFLUENCE OF LOW TEMPERATURES ON FREEZING OF WINTER BUDS OF MERLOT AND CABERNET FRANC GRAPE VARIETIES

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Abstract

In agro-ecological conditions of the experimental field of the Faculty of Agriculture in Zemun "Radmilovac" – Vinča (Serbia), and in the conditions of the cold storage, the influence of low temperatures during hibernation on the percentage of freezing of winter buds in Merlot and Cabernet Franc varieties of grapes were studied. The aim of the study was to examine the resistance of Merlot and Cabernet Franc varieties to low negative temperatures, during four years of observation. Merlot and Cabernet Franc are quite widespread grape varieties in the agro-ecological conditions of Serbia. Therefore, we believe that it is important to establish their sensitivity to low and negative winter temperatures during hibernation. The *in vitro* method of artificial freezing of cuttings of one-year-old shoots in the cold storage was applied. Tests were performed simultaneously on both varieties, three times during the winter: December 15, January 15 and February 15, at two different temperatures -20°C and -25°C. The conditions in the cold storage were identical to the external conditions. The highest frost resistance of both grape varieties was shown in January, while the highest percentage of frozen winter buds was recorded in December. Damage of winter buds was lower at -20°C than at -25°C. Based on the three-way ANOVA, it was found that there were statistically significant differences between varieties, test temperatures, test dates, but also their interaction. However, further analysis for all observed years showed that at a lower temperature, -25°C, there was no statistically significant difference between varieties in terms of their sensitivity.

Keywords: *grapes, freezing, winter buds, low temperatures, Merlot, Cabernet Franc.*

APPLICATION OF V AND D CRYO-PLATE METHODS FOR THE CRYOPRESERVATION OF CHERRY ROOTSTOCK GISELA 5

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Abstract

The possibility of improving cryopreservation success using aluminium cryo-plates was investigated in cherry rootstock Gisela 5. The shoot tips were dissected from *in vitro*-grown shoots and precultured for one day at 25 C in the dark, on Murashige and Skoog (MS) medium containing 0.3 M sucrose. The explants were placed on aluminium cryo-plates with 12 wells and embedded in 2% alginate gel. Osmoprotection was performed by immersing the cryo-plates in loading solution (1.9 M glycerol + 0.5 M sucrose) for 30 min at room temperature. In the V cryo-plate protocol, dehydration was performed at room temperature using two types of plant vitrification solutions: modified PVS2 (37.5% glycerol, 15% dimethyl sulfoxide, 15% ethylene glycol and 22.5% sucrose) for 40 min and PVS3 (50% glycerol and 50% sucrose) for 60 min. In the D cryo-plate protocol, explants were desiccated for 2, 2.5 or 3 h in closed glass containers over silica gel. In both protocols, cryo-plates with explants were transferred in uncapped cryotubes and directly plunged into liquid nitrogen. Rewarming was done by direct immersion of cryo-plates in liquid MS medium containing 0.8 M sucrose (30 min at room temperature). In the V cryo-plate procedure regrowth of cryopreserved shoot tips dehydrated with PVS2 was 95.9%, while for those dehydrated with PVS3 was 85%. As for the D cryo-plate procedure, regrowth ranged between 45.8% and 66.7%. After regrowth, shoots were successfully multiplied and rooted. The results obtained clearly indicate that both cryopreservation procedures using aluminium cryo-plates can facilitate efficient cryostorage of Gisela 5 rootstock.

Keywords: *In vitro* conservation, Aluminium cryo-plates, Vitrification, Air dehydration.

PRINCIPAL COMPONENT ANALYSIS IN EVALUATION OF EARLY MATURING SOYBEAN GENOTYPES

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Abstract

Principal Component Analysis (PCA) is frequently used in breeding work that includes multiple data analysis. This method provides a graphic insight into relationships between traits and evaluates genotypes according to multiple traits. Study encompassed 14 soybean genotypes belonging to maturity group 00 (very early varieties) and of different geographical origin, maintained in soybean collection of Maize Research Institute “Zemun Polje”. Field trials were conducted during two years at two locations, according to a RCB design with three replications. Genotypes were evaluated for 8 major agronomic traits: seed yield, seed number per plant, 1000 seed weight, number of nodes and pods per plant, plant height and protein and oil content. PCA biplot explained a large portion of the variance of standardized data (85.8%). Genotypes were mostly distributed close to the biplot origin, as intermediate for most of the traits. Biplot revealed genotypes of potential importance for different breeding goals. Three varieties achieved the highest grain yield due to the high number of pods per plant and moderately high 1000 seed weight, which could be used in breeding for seed yield. Three genotypes of very high protein content were observed, potentially useful in breeding for improved seed quality. One genotype had the highest 1000 seed weight, the protein content above the group average while it was intermediate in seed yield. Correlations among traits determined by PC biplot were in accordance with Pearson’s correlation coefficients.

Keywords: *Evaluation, Agronomic traits, Correlations, PCA.*

THE INFLUENCE OF AGROECOLOGICAL CONDITIONS OF GROWING ON THE CHEMICAL PROPERTIES OF BURLEY TOBACCO

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Abstract

Tobacco production in Republic of Serbia today includes two types of tobacco because Oriental tobacco has no longer been produced since 2016. The aim of this experiment was to determine the influence of agroecological conditions on the chemical properties of Burley tobacco from five different production areas in Serbia during 2013. First class middle leaves of Burley tobacco from Senta, Čoka, Šabac, Bajina Bašta and Vranje municipalities/towns were used as research material. Analysis included the characterization of soil (pH value and organic matter) and determination of following tobacco chemical components: total proteins, nicotine, reducing sugars, pH and ash. All analyzes were performed by standardized methods in three replications. Hydrometeorological conditions data for vegetation period were taken from the Republic Hydrometeorological Institute of Serbia. The results showed that agroecological conditions of growing had an influence on the amount of chemical components, since the same agrotechnical measures were applied in all five production areas and the same amount of fertilizer was used. The positive correlation between nicotine content and the air temperature and percentage of organic matter in the soil was determined, as well as the negative correlation with the amount of precipitation. Tobacco protein content showed positive correlation with pH value of soil and negative correlation with the amount of precipitation. In addition to that, the positive correlation was found between the sugar content of tobacco and the air temperature and soil pH value, while sugar content was in negative correlation with the amount of precipitation. The ash content and the pH value of tobacco increased with the pH and percentage of soil organic matter, but decreased with the amount of precipitation.

Key words: *burley tobacco, chemical properties, climate conditions, soil properties.*

PHYSICAL AND CHEMICAL CHARACTERISTICS OF THS IN RELATION TO STANDARD CIGARETTE

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Abstract

In order to reduce the harmful effects of cigarette smoke on the health of active and passive smokers, a new tobacco product - Tobacco heating system (THS) has been developed. Heating, rather than burning tobacco reduces the level of harmful and potentially harmful ingredients in the aerosol. New products are compared to cigarettes, because cigarettes are the most represented and most tested tobacco product on the market. This study aimed to compare the new THS product - IQOS (HEETS cartridges) and the Marlboro cigarette from the same manufacturer, which were available on the Serbian market. The physical characteristics of both products, the chemical characteristics of the aerosols and the amount of heavy metals in the aerosol were analyzed using standardized methods. Measurements were made in three replicates. The physical characteristics of the product showed that HEETS was 2.2 times shorter than a cigarette, 1.95 mm smaller in diameter and 25% less in weight than a cigarette. The content of total particulate phase (TPM) was reduced by 72.19%, nicotine by 30.99%, and the amount of TAR by 98.85% in HEETS condensate in relation to cigarette. Aerosol chemical analysis results indicate that the new THS product offers a lower health risk compared to traditional cigarettes consumption.

Keywords: *THS, HEETS, cigarette, aerosol.*

ANALYSIS OF GROWING AND TURNOVER OF TOBACCO IN REPUBLIC OF SERBIA

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Abstract

Raw tobacco production in the world has a long tradition and is widespread throughout the continents. Due to polymorphism as one of its most prominent traits, tobacco has adapted to all conditions under which it is grown. In addition to natural conditions, the most important of which are soil type and climate, raw tobacco production is also influenced by economic factors, such as the world market price of tobacco, government support and global anti-smoking policies. The aim of this paper is to present and analyze tobacco growing and turnover in Serbia, based on the collected data and information. The importance of the paper is in recognizing the structure and dynamics of production and marketing, as well as their causes, primarily because the production of this species brings significant economic benefits to the state, both through the realization of the products themselves, as well as through the creation of new jobs and income from taxes. The statistical data of the Statistical Office of Republic of Serbia, as well as the research results of the place and role of tobacco production in Republic of Serbia, served as the main source of data in the preparation of this paper. The data was analyzed using mathematical and statistical analysis, while relative dynamics indicators, baseline indices and average growth rates were used to demonstrate the status, changes and potential in tobacco production in Republic of Serbia.

Keywords: *tobacco, production, condition, market, selling.*

THE STATE AND PRODUCTION OF GRASSLANDS IN SERBIA

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Abstract

Given that Serbia (without Kosovo) has large areas under grassland, the aim of this study was to analyze the variation and trend of the areas, total production and yields over 71 years (1948-2018) and prognosis of yield in the next 30 years. The results indicated that the area of grasslands in Serbia declined over the last decade. Most grasslands in hilly-mountain region were degraded and without application of agrotechnical - remedial measures so that large areas were lost. In Autonomous Province of Vojvodina, areas of grasslands have been declining because have been converted into arable land. Total production of meadows increased while total production of pastures decreased during the observed period. The grasslands areas in Serbia showed low yields. In the Vojvodina region, meadows showed decrease in forage productivity, while pastures showed increase in forage productivity. Areas under meadows and pastures should be recultivated and brought into production in accordance with the needs of livestock development. This will result in higher quantity and higher quality production of green mass and hay. Unfortunately, depopulation and under-representation of animals per unit area represented a limiting factor for grassland exploitation. On the other hand, in the future yield growth rates of grasslands in Serbia and Central Serbia and pastures in Vojvodina will very low increase. Contrary, yields growth rates of meadows in Vojvodina will decrease by 2050.

Keywords: *Grasslands, Yield changes, Trend analysis, Serbia.*

INFLUENCE OF GROWTH RETARDANT REGALIS ON BLACKBERRY FRUIT QUALITY

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Abstract

In the group of berry species, blackberry is, by economic importance for Republic of Serbia, immediately behind raspberry and strawberry. As a consequence of the hyper-production on one side and the uncertain sales prospects on the other side, the average blackberry production in Serbia has declined in recent years to approximately 12,000 t (spread to app. 15,000 individual farms). The blackberry orchards in Serbia are dominated by the Čačanska Bestrna and Thornfree cultivars, with more than 95% share, followed by the Black Satin, Dirksen Thornless and some more recent cultivars, such as Loch Ness, Chester Thornless, Triple Crown. The intensification of the cultivation technology accompanied by the introduction of the application growth retardant resulted in increasing the share of quality fruits, i.e. reducing vigour of bush. The paper presents results of a two-year study (2018–2019) into the impact of foliar application Regalis (growth retardant) on morphometric and chemical properties of blackberry fruit. It was observed that most of the tested parameters were affected by foliar application of retardant during the research, as well as by their interaction. In terms of the morphometric properties, weight (10.89 g), height (34.14 mm), and width (26.90 mm) were higher in treatment with Regalis than treatment without application. All chemical properties tested, soluble solids (9.95%), total sugars (4.98%), inverted sugars (4.71%) content, except sucrose and total acids content had higher values in the same treatment. In addition to this, the foliar application of Regalis had a positive effect on the content of secondary metabolites (total anthocyanins-67.11 mg/100 g FW; total phenols-636.06 mg/100 g FW), and antioxidant capacity of fruit (2.53mmol Trolox/100 g FW).

Key words: *physical traits, primary metabolites, phenols, blackberries.*

WEED CONTROL ABILITY IN SWEET MAIZE OF SINGLE SOWN LEGUME COVER CROPS COMPARED TO THEIR MIXTURES

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Abstract

To achieve efficient weed control through cover cropping, the plant species chosen is very important. Growing different legume cover crop (CC) species single and in mixtures with grass may increase the number of provided ecosystem services, including reliable suppression of weeds. We conducted an experiment using randomized complete block design with four replications in 2014/15 - 2015/16 growing seasons, at the Experimental Field of Maize Research Institute in Zemun Polje (Serbia). Single cover crops were considered as the main factor (common vetch and field pea), mixtures common vetch and field pea with winter oats and traditional variant, without coverage on biomass. Green biomass of the cover crops was incorporated in the soil, and treatments with favorable establishment and above-average biomass yields tended to suppress weeds by showing lower weed dry matter and weed numbers. The weediness of sweet maize was much higher in the second year of investigation. The number of weed species, fresh and dry biomass of weeds were the least in the variants with mixtures, while the number of plants per species was the lowest in the single cover crops. So, mixtures were not as effective as legume single sown CCs, species combinations increased resilience against adverse weather conditions, an advantage to achieving efficient weed control over a long-term period. The statistically significant difference in the fresh biomass of weeds obtained in the control variant (540.46 and 385.88 g) was especially pronounced compared to the variants with single cover crops (391.63 and 486.53 g) and their mixtures (260.00 and 250.78 g), indicating a higher proportion of perennial weed species.

Keywords: *cover crops, plant diversity, main crop, weed management.*

YIELD AND GROWTH EFFICIENCY OF GARLIC CROP (*Allium sativum* L.) IN RESPONSE TO FOLIAR SULPHUR FERTILIZATION

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Abstract

Despite its relevance, sulphur is poorly utilized by the *Allium* vegetables when improperly applied. Thus, the objective of this study was to examine the effects of fertilization on biomass yield and individual growth components of garlic (*Allium sativum* L.). Field experiment was carried out on the silty clay soil at the family farm in the Vipava Valley, at an altitude of 85 m ($\varphi = 45^{\circ} 86' 63''$; $\lambda = 13^{\circ} 84' 87''$). The experiment comprised of two different factors such as two early autumn planted garlic ('Garpek' and 'Gardacho') and two different fertilizers. To establish this, we sprayed half of the plants with the Azos 300 foliar fertilizer four times (8l/ha was used in total), while the other half was left unsprayed (control group). The treatments were laid out in randomized complete block design with four replications. Data processing involved comparing average values for individual repetitions of different treatments and varieties. Data showed a significant difference among most of the growth parameters. Maximum bulb weight (70.7 g), bulb diameter (6,5 cm) and marketable yield (1,8 kg/m²) was recorded for cultivar 'Gardacho' with the application of Azos 300 foliar fertilizer.

Keywords: Garlic, fertilization, yield.

IN VITRO GROWTH OF *LOLIUM MULTIFLORUM* LAM. AS AFFECTED BY THE METHOD OF APPLICATION OF ENDOPHYTIC FUNGI

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Abstract

Different species of fungal endophytes have already been described as plant growth promoters of their hosts and, therefore, their inoculation may help increase crop yield and reduce the use of chemical fertilizers. However, the effect is not always constant, but strongly influenced by the environment. An alternative to reduce this variability could be the direct application of the compounds produced by these fungi, responsible of the beneficial effect. To assess this hypothesis, the influence of three fungal endophytes on the germination and growth of *Lolium multiflorum* Lam. was determined under laboratory conditions, evaluating the effect of the inoculums type and time of application. The endophytes were selected for their capacity to produce indoleacetic acid and their potential scavenging activity with 2,2-diphenyl-1-picrylhydrazyl, both parameters related to plant growth. For the experiments, endophytes were first cultured and then inoculated in three different inoculums types (mycelium, culture filtrate and crude extract) to determine their effect on seed germination and seedling growth. The best results for the 10-day germination test corresponded to a different combination of endophyte and treatment: *Boeremia exigua* as extract (88.3%), *Xylariaceae* sp. as filtrate (75.0%) and *Chaetosphaeronema sp1.* as mycelium (78.3%) showed significant increases with respect to their blank (~60%). In the case of the seedling inoculation, *B. exigua* and *Xylariaceae* sp. inoculated as either filtrate or extract, significantly increased growth parameters such as herbage and root dry matter, which supported the potential of these isolated compounds to be used for plant growth promotion.

Keywords: *Fungal endophytes, Plant growth, Phytohormone, Antioxidant.*

POTENTIAL OF FORAGE PEAS TO ALLEVIATE SELENIUM AND ZINC DEFICIENCIES IN LIVESTOCK BY AGRONOMIC BIOFORTIFICATION

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Abstract

Although selenium (Se) and zinc (Zn) are two essential micronutrients for animals, their intake is usually deficient in many regions worldwide due to their low concentration in forages. Agronomic biofortification has been shown to be very effective to increase their concentration in the edible parts of plants. To evaluate the suitability of forage peas to be biofortified with a combined treatment of Se and Zn, a two-year field experiment was conducted under semiarid conditions in Southwest Spain. A split-split-plot design was established, including the study year (2017/18 and 2018/19) as main plot factor, soil Zn application (50 kg Zn ha⁻¹, 0 Zn) as subplot factor, and foliar application (0, 10 g Se ha⁻¹, 8 kg Zn ha⁻¹, 10 g Se ha⁻¹ + 8 kg Zn ha⁻¹) as sub-subplot factor. Selenium was applied as Na₂SeO₄ and Zn as ZnSO₄·7H₂O. Among the parameters evaluated, results showed that the combined application of soil Zn, besides the foliar application of Se and Zn, produced an increase of almost 30% in forage yield, and of around 8% in the value of crude protein in comparison with the no-fertilized control. The concentration of Se and Zn in forage increased 5-fold and 4-fold, respectively when such a combined treatment was applied, reaching thus values quite close to the recommended daily allowance. Therefore, forage peas might have a high potential to be biofortified with Se and Zn as their concentration in forage widely increased and the productive and nutritive parameters of forage responded very positively.

Keywords: *Semiarid conditions, combined biofortification, Animal feeding, Forage crops.*

DETERMINATION OF GENETIC DIVERSITY OF PEAR "PYRUS SYRIACA. BOISS" GENOTYPES AT THE SOUTH OF SYRIA BY USING THEIR MORPHOLOGICAL TRAITS AND MOLECULAR MARKERS

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Abstract

This investigation was conducted in Sweida governorate- Syria to study the genetic diversity and relationships among *Pyrus syriaca* Boiss. genotypes and local pear cultivars depending on morphological traits and SSR molecular markers. The results showed the existence of seven wild pear genotypes belonging to *P. syriaca* Boiss. with different morphological traits of their shoots, leaves, fruits, growth habit and phenological stages distributed at altitude 900-1600 m. The obtained wild pear genotypes were evaluated depending on desirable traits of seedlings that resulted from seed propagation and three suitable genotypes were selected to be used as pear rootstocks. SSR molecular markers were applied on the three selected pear genotypes and three local pear cultivars to determine the genetic relationship among them using 15 selective primer pairs. Fourteen primer pairs were able to amplify 45 alleles, 41 of them were polymorphic alleles with polymorphism percentage 91.1%. The number of alleles per locus ranged between 1-6 alleles with an average 3.2. The highest percentage of genetic similarity was between G3 wild genotype and Meskawi cultivar (0.542), while the lowest percentage was between the local cultivars Romi and G1 genotype (0.219). Cluster analysis divided the studied genetic resources into two clusters; the first cluster contained only Romi cultivar, while the second cluster included all other studied cultivars and genotypes. Ten primer pairs of 14, revealed 24 unique alleles (21 positive and 3 negative alleles). The average of heterozygosity H_e was 0.26. Consequently, SSR technique was powerful tool to identify all investigated pear genotypes and the ability to use it in the breeding and genetic improvement programs.

Key words: *Pear, P. syriaca, genetic diversity, morphological evaluation, SSR molecular technique.*

**ASSESSMENT OF GENETIC VARIATION AMONG *PISTACIA ATLANTICA* DESF.
REGARDING SEXUAL GENOTYPES (MALE, FEMALE AND
HERMAPHRODITIC) USING ISSRS. MARKERS**

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Abstract

All *Pistacia* species are dioecious, male and female flowers are born on separated trees. Our recent studies identified new hermaphroditic genotypes of *P. atlantica* with different structure of racemes and flowers at the south of Syria. Therefore, the current research aimed to assess genetic variation among 11 genotypes (3 female, 5 hermaphroditic, 3 male) across fifteen ISSRs primers in Sweida Research Center (2018-2019). All of the primers were able to detect the polymorphism, which revealed 214 bands, 205 of them were polymorphic (95.79%). The number of bands for each primer ranged from 6 to 33, with an average 14.27 bands for each Primer. Genetic similarity among all studied genotypes ranged from (0.27) between hermaphroditic genotype (PA52) with female genotype (FA3) as well as between MA3 male genotype and FA2 female genotype, while the highest genetic similarity was 0.77 between two hermaphroditic genotypes (PA37 and PA52). Cluster analysis grouped all studied genotypes into three main clusters according to their sexual structure; the first cluster contained all of the hermaphroditic genotypes and the second cluster comprised of all male genotypes, while the third cluster included all female genotypes. The results demonstrated the importance and the efficiency of ISSR technique by revealing the genetic variation among *P. atlantica* genotypes and separating all of them into detached clusters according to their sexual structure. Farther more, some primers were able to detect common bands in each sexual structure which might help to understand the mechanism of sexual inheritance within the studied species.

Key words: *hermaphroditic genotypes, genetic similarity, P. atlantica, ISSR technique.*

SELECTION OF NEW APPLE ROOTSTOCKS DEPENDING ON LOCAL GENETIC RESOURCES IN SYRIA

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Abstract

This investigation is part of apple rootstock breeding program conducted at General Commission for Scientific Agriculture Research – Pome and Grapevine Division in Sweida governorate (Syria). The objectives were to select new apple rootstocks appropriate for local environment (tolerance/resistance to pests, diseases and abiotic stress factors), and to detect some desirable attributes using molecular markers. The work was performed by using 9 local genetic resources (5 seedling genotypes, 3 local apple cultivars and hybrid of the local apple cultivar ‘Skarji’ and MM106 rootstock). The obtained results led to select 3 genotypes (Sukari Alswieda ‘S’, Alswieda1 ‘B’ and Skarji Alswieda ‘H’) as rootstocks which revealed the standard attributes of rootstock, and showed a high genetic similarity among the seedlings belong to the same mother plant, and high percentage of successful budding with commercial cultivars observed as well. ‘S’ rootstock was classified as vigorous rootstock, it could be propagated either by seeds or vegetative propagation, efficient root system is producible in either way. Moreover, ‘S’ rootstock produced the highest number of seedlings which revealed 4 drought tolerant genes. ‘B’ rootstock was classified as a moderate vigor rootstock, and it could be propagated by seeds. ‘H’ rootstock was classified as a moderate to vigor vegetative rootstock, showing phenotypic and genetic resistance to woolly apple aphid. Consequently, the use of the local selected rootstocks is necessary to improve apple cultivation in Syria.

Key words: *apple, Malus sp., seedling and vegetative propagated rootstocks, rootstocks tolerant to drought.*

VALORIZING LOCAL TUNISIAN GENETIC RESOURCES THROUGH THE SUSTAINABLE DEVELOPMENT OF NEW MELON F₁ HYBRIDS

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Abstract

Conventional breeding using local genetic resources has an important role in sustainable agricultural development. In Tunisia, a long term breeding program at CRRHAB, led to the selection of eight melon local landraces. These selected genetic resources were subjected to inbreeding for 4-6 generations. The general combining ability among all inbred lines was tested and five inbred lines were selected and utilized in a half diallel cross (5 x 5) to produce ten local F₁ hybrids. The aim of this study was to investigate the possibility of breeding new local F₁ hybrids based on Tunisian genetic resources. The inbred lines and their F₁ hybrids were evaluated for maturity, average weight per fruit, yield, fruit quality (fruit size, rind thickness and soluble solids) over a period of one planting season during 2019 and were compared with commercial hybrids. The results showed that most of the evaluated traits were improved by hybridization. Indeed, heterosis over the best parents was recorded in most of the combinations. The results evidenced that some local F₁ hybrids might be promising since they produced a higher yield and better fruit quality than some commercial hybrids, and they could be commercially competitive. Further studies are needed to evaluate these promising hybrids and to extend this research to other characters of economic importance, in particular those of tolerance and / or resistance to melon diseases and pests.

Keywords: *Melon, Breeding, Heterosis, Hybrids, Sustainable.*

DIVERSITY ON FRUITS OF WILD GROWN SEA BUCKTHORN (*HIPPOPHAE RHAMNOIDES* L.) FROM DIFFERENT REGIONS IN TURKEY

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Abstract

Sea buckthorn (*Hippophae rhamnoides*) is a naturally growing shrub that is native to Eastern Europe and Asia and is found in the abundance in the Indian subcontinent, especially the North Western Himalayan regions. Due to its beneficial effects for humans, sea buckthorn has recently become quite popular herbal medicine in phytotherapy and food applications. In this study, physicochemical characterization (color parameters, pH, titratable acidity, total soluble solids, total carotenoid and total phenol contents), antioxidant activity (by ferric-reducing antioxidant power, FRAP assay), and quantification of some individual phenolic compounds of fruits of 15 samples of different sea buckthorn genotypes collected from different regions of Turkey were investigated. Results showed that, the total phenols were in the range of 157-204 mg gallic acid equivalent (GAE)/g fresh weight (fw). Chlorogenic acid and isoquercetin were found to be the most abundant phenolic compounds in the extracts of sea buckthorn fruits. The considerable variations in the antioxidant activity and phenolic compounds of sea buckthorn genotypes were demonstrated by our results. Hence, the evaluation of sea buckthorn genetic resources could supply precious data for screening genotypes with high bioactive contents for producing natural antioxidants and other phytochemical compounds valuable for food and pharmacy industries.

Keywords: *Hippophae rhamnoides*, *Bioactive content*, *Morphological diversity*.

MECHANIZATION OF HEMP HARVEST AND ITS IMPORTANCE

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Abstract

Hemp (*Cannabis sativa* L.) is one of the first important cultured plants in human history to be cultivated for its fiber and seed. All hemp plant components are evaluated in different ways in the industrial and textile fields. Hemp is used in different fields such as textiles, paper, cosmetics, pharmaceuticals, automotive, furniture, nutrition, construction materials. It has also recently gained importance as a renewable raw material for the production of strong, lightweight, composite materials. There are factors that limit the commercialization of hemp in the agro-industrial chain. From an agricultural point of view, deficiencies in harvesting methods are important among these factors. For example, the production of quality fiber is related to the quality of the raw material, which is linked to the efficiency of the harvesting system. Often, solutions to these problems in harvesting methods have been tried to be found with local agricultural practices. Harvest time is important in hemp because late harvest should not be done. Delayed harvesting leads to increased sap yield, but to decreased fiber yield and quality in the plant. Therefore, hemp reaching harvest maturity should be harvested as soon as possible. Hemp harvesting is usually done by hand, but in recent years the method of machine harvesting has also been used. Harvesting by hand causes too much labor and time to be wasted. As a result of the surplus labor requirement, the chances of competition against other fibrous plants decreased and the cultivation area decreased in many countries. For this reason, especially machine harvesting has increased its importance day by day. Harvesting and fiber processing vary depending on whether the crop is grown for quality textile fiber, seed or for fiber and seed. Hemp harvesting has developed on a local basis. However, research is still ongoing on harvesting machine where fiber quality will be maintained and seed loss will be minimal in existing harvesters. In particular, hemp harvesting mechanization focuses on reducing the losses in the mowing patterns of harvesters and increasing labor efficiency. Nevertheless, it has to be stated that harvesting machines based on finger or double knife cutter bars have not made any appreciable progress on the market yet. The aim of this paper is to present a review of the existing the current mechanical harvesting systems for Hemp, one of the most efficient fiber plants, and to provide information about the machines that need to be worked on. It is also to provide information about recent developments to improve harvesting processes in hemp.

Keywords: *Hemp, Fiber, Mechanization, Harvesting, Harvester.*

DETERMINATION OF SOME SPRAYING CHARACTERISTICS OF DIFFERENT HYDRAULIC NOZZLES

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Abstract

There are various methods in agricultural production to combat with diseases, pests and weeds in order to obtain quality products. In general, the "chemical control method" is preferred as it is possible to obtain the result in a short time frame. In the chemical control method, wrong application technique and unconscious use of pesticides cause negative outcomes in terms of human health and the environment. These risks can be prevented with effective use of pesticides. There are many factors that effect the success in application of pesticides. If there exist missing or wrong factors, that disrupts the quality of the application. Among the factors that determine the success and quality of the application, spraying characteristics are extremely important. Through accurately chosen spraying characteristics, pesticides can be used effectively with lower risk. In this study, some spraying characteristics (volum median diameter (VMD), spray uniformity and surface coverage are determined in four different hydraulic nozzle types (3 flat fan nozzles and one hollow cone nozzle). Experiments are done in field conditions and the spotting method is used to determine spraying characteristics. In the spraying method, applications are performed by using water sensitive papers (WSP) and analyzes of the water sensitive papers are done with UTHSCSA Image Tool for Windows V3 image processing program. The amount of the applied pressures are 4 - 5 bars on the flat fan nozzles, and 6 - 8 bars on the hollow cone nozzles. As a result of the applications, (volum median diameter values are ranged between 186.6-226.0 μm on flat fan nozzles and 112-145 μm on hollow cone nozzle. Surface coverage and spray uniformity values are found in order of 16.4% -28.5% and 1.16-1.56% in flat fan nozzles and hollow cone nozzle. In applications of different pressures, the results are found close to each other between the flat fan nozzles. However, some differences are found between the flat fan nozzles and the hollow cone nozzle type.

Keywords: *Flat fan nozzle, Hollow cone nozzle, Volum median diameter, Water sensitive paper, Image processing method.*

DETERMINATION OF DIFFERENT MECHANICAL HARVESTING SYSTEMS OF BLACK TABLE GEMLIK OLIVE VARIETY(OLEA EUROPAEA CV. GEMLIK)

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Abstract

The research was conducted at the trial area of Atatürk Central Horticultural Research Institute in the south of the Marmara region of Turkey in Gemlik olive variety (*Olea europaea* cv. Gemlik) orchard to determinate the harvesting performance of different harvesting methods namely limb shaker, hand picking and trunk shaker. Trunk shaker with eight different frequencies were operated. Three different shock frequencies were determined as 18+22 Hz, 22+25 Hz, 22+28Hz. Harvest studies were carried out with hand picking (three laborers) and limb shaking machine (LSM) (one laborer/operator) and trunk shaking machine (TSM) (one laborer/operator) 18 Hz, 20 Hz, 22 Hz, 25 Hz, 28 Hz frequencies and 18+22 Hz, 22+25 Hz, 22+28 Hz frequency combinations) (one laborer/operator) with 8 s vibration duration within 5 repetitions. Trials were done on 5 trees on Gemlik table olive cultivar for each variable. TSM harvesting was completed by one laborer (operator) operates the trunk shaker. In the first and second year of the experiments at the optimum harvest time, fruit volume, fruit detachment force, fruit weight, the ratio of fruit detachment force to fruit weight were found to be 3.9-4.0 cm³, 3.27-3.99 N, 4.23-4.28 g, 0.77-0.94 respectively. Best results were obtained by using the trunk shaker with low frequencies as Trunk shaker 22 Hz for 8 sec. Damage levels, harvesting efficiency, duration of operation per tree and work productivityof trunk shaker with 22 Hz were found as 2.86%-7.24%, 93.93%-92.92%, 2.51-2.81 min tree⁻¹ and 286.22-355.72 kg h⁻¹ respectively in two-years trials.

Key words: *Trunk shaker, Vibration, Olive Harvesting, Harvest performance.*

HOW DOES LATE SOWING AFFECT TO GROWING OF WHEAT (*TRITICUM AESTIVUM* L.) AT EARLY STAGE?

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Abstract

Climate change has direct and indirect effects to agriculture all over the world. One of the negative effects is uneven and intensive precipitation. At last decades, wheat cultivation has faced intensive rain amounts especially in sowing time in Turkey and this situation led to late wheat sowing. As considering this problem, there is need to find what is changed in wheat growth and development in order to tolerate negative effects of late sowing. For this purpose, the experiment was conducted in three different sowing time (ST₁: 09.12.2019, ST₂: 03.01.2020 and ST₃: 17.01.2020) as three replications. The wheat plants were sampled in similar growth stages at each plot. RGR (Relative Growth Rate), NAR (Net Assimilation Rate) and CGR (Crop Growth Rate) were calculated by measuring dry weights and leaf areas from sampled wheats. Besides, wheat growth (by using Zadoks Scale) and phyllochron was measured in three days interval until last leaf was appeared in main stem. As results of study, the wheat of ST₁ had higher RGR as 56.4 mg g⁻¹ day⁻¹ than ST₃ (52.2 mg g⁻¹ day⁻¹) and ST₂ (43.9 mg g⁻¹ day⁻¹). Similarly, NAR were found 4.16 mg cm⁻² day⁻¹, 0.99 mg cm⁻² day⁻¹ and 0.81 mg cm⁻² day⁻¹ at ST₁, ST₃ and ST₂ respectively. However, ST₃ had highest CGR value as 528 mg m⁻² day⁻¹ and following by ST₂ (486 mg m⁻² day⁻¹) and ST₁ (298 mg m⁻² day⁻¹). Vegetation time of wheat was shortened when sowing time was late. Furthermore, growth stage of late sowing wheats reached to growth stage of first sowing wheats almost after 6th leaf appeared. As conclusion, it was suggested that late sowing had negative effects to growing of wheat and it was needed to study on morphological and physiological features of wheat.

Keywords: *Wheat, Triticum aestivum, Late sowing, Growth of wheat.*

HOW DOES LATE SOWING AFFECT TO GROWING OF WHEAT (*TRITICUM AESTIVUM* L.) AT EARLY STAGE?

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Abstract

Climate change has direct and indirect effects to agriculture in all over the world. One of the negative effects is uneven and intensive precipitation. At last decades, wheat cultivation has faced to intensive rain amounts especially in sowing time in Turkey and this situation lead to retard wheat sowing. As considering this problem, there is need to find what is changed in wheat growth and development in order to tolerate negative effects of late sowing. For this purpose, the experiment was conducted in three different sowing time (ST₁: 09.12.2019, ST₂: 03.01.2020 and ST₃: 17.01.2020) as three replications. The wheat plants were sampled in similar growth stages at each plot. RGR (Relative Growth Rate), NAR (Net Assimilation Rate) and CGR (Crop Growth Rate) were calculated by measuring dry weights and leaf areas from sampled wheats. Besides, wheat growth (by using Zadoks Scale) and phyllochron was measured in three days interval until last leaf was appeared in main stem. As results of study, the wheat of ST₁ had higher RGR as 56.4 mg g⁻¹ day⁻¹ than ST₃ (52.2 mg g⁻¹ day⁻¹) and ST₂ (43.9 mg g⁻¹ day⁻¹). Similarly, NAR were found 4.16 mg cm⁻² day⁻¹, 0.99 mg cm⁻² day⁻¹ and 0.81 mg cm⁻² day⁻¹ at ST₁, ST₃ and ST₂ respectively. However, ST₃ had highest CGR value as 528 mg m⁻² day⁻¹ and following by ST₂ (486 mg m⁻² day⁻¹) and ST₁ (298 mg m⁻² day⁻¹). Vegetation time of wheat were shortened when sowing time is retarded. Furthermore, growth stage of late sowing wheats reached to growth stage of first sowing wheats almost after 6th leaf appeared. As conclusion, it was suggested that late sowing has negative effects to growing of wheat and need to study on morphological and physiological features of wheat.

Keywords: *Wheat, Triticum aestivum, Late sowing, Growth of wheat.*

THE ESTIMATION OF HEAT AND DROUGHT TOLERANCE MAIZE LINES USING DNA MARKERS

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Abstract

The main factor which causes to decrease maize grain yield is drought. In most regions where maize is grown, the water stress during the growing period is caused by both lack of soil moisture and high air temperature. The purposes of our study were the estimation and selection of maize lines for drought and heat tolerance based on DNA markers and determination of the correlation between CAPS markers and plant ability to resist the water stress. As the result of study, the significant differences were found between leaf temperature of maize lines which contained favorable alleles by both CAPS markers in 2018 and 2019 (35.72 and 34.41°C respectively), $LSD_{0.05}=1.27$. The leaf temperature of maize lines which had SNP (A) by dhn C397 (36.95°C) differed significantly with lines contained favorable allele by rspC1090 or lines with no favorable alleles in 2018 (33.68 and 34.35°C respectively). Based on analysis by seeds germinating in sucrose solution the significant differences were observed between the amount of sprouted seeds in lines contained SNP(G) by rspC1090 and lines without any favorable allele (4% and 2.25% respectively), $LSD_{0.05}=1.70$. As the result of correlation analysis, the positive correlation was determined between SNP(A) by dhnC397 marker in maize lines and leaf temperature in 2018-2019 ($r=0.16$). The positive correlation was observed between SNP(G) by rspC1090 and the percent of sprouted seeds in sucrose solution ($r=0.31$). Thus, for complex estimation and maize line selection for drought and heat tolerance it could be recommended to use two CAPS markers dhnC397 and rspC1090.

Keywords: *drought, high temperature, CAPS markers, correlation, maize.*

NEW APPROACHES IN GROWING TECHNOLOGY OF *VALERIANA OFFICINALIS* L. UNDER THE CONDITIONS OF CLIMATE CHANGE

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Abstract

There is an acute shortage of soil moisture in critical periods of growth and development of *Valeriana officinalis* L. on the territory of Ukraine. Classical technologies previously used for growing crops do not allow to obtain consistently high yields of roots under the conditions of climate change. Therefore, in order to find new effective methods of valerian growing, research studies have been conducted to establish the impact of drip irrigation, mineral nutrition, sowing dates on productivity and phytosanitary condition of valerian crops in Ukraine. The moisture content of the root layer of the soil was maintained at the level of 85% of the lowest moisture content, when irrigation was used. Mineral fertilizers in the dose of N₉₀P₉₀K₉₀ were applied for the main tillage and N₃₀P₃₀K₃₀ for fertilization. Sowing was carried out in two terms (spring and winter). The yield of valerian depended only on the weather conditions of the year, when irrigation was not used. In the first year of research, the natural soil moisture was the highest among all years of research. The yield of valerian raw materials was 19.4 – 26.3 quintal/ha for spring sowing of the first year. For the second year of research – it was only 5.4 – 7.9 quintal/ha due to summer drought. For the third year no seedlings were obtained due to the spring drought. On average over three years, the use of drip irrigation in combination with mineral fertilizers provided 26.3 – 36.6 quintal/ ha yield of dry roots. Prolongation of vegetation during winter sowing, application of irrigation and mineral fertilizers (with their application in the dose of N₉₀P₉₀K₉₀ mainly) provided a yield of 36.8 quintal/ha. The highest yield of valerian roots was 42.2 quintal/ha obtained for winter sowing when irrigation was used in combination with the application of basic fertilizer N₉₀P₉₀K₉₀ + fertilization N₃₀P₃₀K₃₀. Under the conditions of drip irrigation dangerous pathogens for valerian were *Erysiphe cichoracearum f. valerianae*, *Ramularia valerianae*, *Uromyces valerianae*, *Septoria valerianae*, *Peronospora valerianae*, and also fungus of the genus *Fusarium* and viruses. Stable yields of valerian raw materials under the conditions of climate change were obtained with the use of drip irrigation and mineral fertilizers with the extension of the growing season of valerian due for winter sowing.

Keywords: *Valeriana officinalis* L., drip, irrigation, yield, mineral fertilizers.

THE STUDY OF PHYSIOLOGICAL AND BIOCHEMICAL CHARACTERISTIC OF WINTER RAPESEED (*BRASSICA NAPUS* L.) UNDER THE CONDITIONS OF DROUGHT

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Abstract

Modern breeding requires the use of effective methods to increase the adaptive capacity of plants, which is impossible to implement without the development and introduction of new methods of breeding genotype evaluation. Today, in the context of global warming, an urgent task is the creation of highly productive drought-tolerant rapeseed genotypes. An experiment with increasing artificial osmotic stress in growth media for the germination of winter rapeseed seeds showed that the germination process parameters varied by a genotype and a concentration of sucrose. None of the genotypes under study revealed a linear dependence of a decrease in the number of germinated seeds under increasing sucrose concentration in growth medium. The study found that anionic peroxidases in the leaves of winter rapeseed obtained under the conditions of osmotic stress demonstrated high activity in oxidation rate of benzidine hydrochloride, which was the decomposition product of hydrogen peroxide. Winter rapeseed hybrid Tekhnik showed the most rapid increase in the optical density of the reaction mixture, relative to time, at high concentrations of sucrose, 40, 80 and 100 g/L (more than 2.5 units for 28 s). The study revealed a dependence of the drought tolerance indices of plants on the osmotic pressure of the medium due to the sucrose concentration. Thus, the relationships between the nature of the chemical reaction of benzidine oxidation, the increase in the optical density of the reaction mixture and the quantitative calculation of seed germination rate were shown in the study of seedlings of different winter rapeseed genotypes grown on growth media supplemented with sucrose in high concentrations.

Keywords: *winter rapeseed, benzidine hydrochloride, osmotic stress.*

THE INFLUENCE OF THE QUERCETINE-IRON COMPLEX ON PLASTID PIGMENTS AND SECONDARY SYNTHESIS IN *RUBUS IDAEUS* L., *RIBES NIGRUM* L. AND *FRAGARIA ANANASSA* DUCH *IN VITRO*

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Abstract

The biological action of flavonoid in a plant is connected with the regulation of redox processes, stabilization of different membranes, modulation of the enzymes and receptors activity. The antioxidant properties of flavonoids are based on their ability of chelating metal ions involved in peroxidation. In the study, we tested the ability of the flavone aglycone – quercetin to create a chelate complex with Fe^{2+} and to regulate physical processes connected with the redox reactions, synthesis of pigments and metalloenzyme in the medium. When added to the composition of medium, quercetin-iron complex with a Fe^{2+} fraction in the concentration equivalent to base media, cultured plants showed significantly high regenerative capacity. Under the conditions of increasing concentration of metalloflavonol in the medium, raspberry, and garden strawberry plants did not form morphogenic callus on the main parts of the stems, which was being filled with the oxidation products as time passed, whereas external cells darkened and eventually died off. In raspberry leaves *in vitro*, the total content of phenols and, in particular, flavonoids and catechins compared to the plants of the control treatment was sufficiently uniform, whereas in the treatment with the quercetin-iron complex it was slightly higher. In black currant plants, the total pool of phenols and catechins increased, the content of flavonoids was quite stable, and in garden strawberry, the content of flavonoids slightly increased. Thus, quercetin is a biologically active phenolic chelating agent, which under the conditions of individual selection and composition of chelate complex and its concentration in medium should be used for micro clonal propagation of plants sensitive to oxidase stress under the conditions of Fe^{2+} deficiency.

Keywords: *berry plants, quercetin, flavonoids, pigments, in vitro.*

EFFECT OF DIFFERENT NITROGEN FERTILIZER LEVELS ON YIELD AND QUALITY OF GREEN FODDER MORINGA OLEIFERA

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Abstract

This study was aimed to determine the optimal nitrogen fertilizer levels for the green fodder *Moringa oleifera* for foliage meal production for chicken diet supplement purpose. The study was conducted during 3 years (2017 – 2019) at Thainguyn University of Agriculture located in northern mountainous area of Vietnam. In the trial, 5 different nitrogen fertilizer levels were tested, hereinafter refers to as formulas (NT). There were NT1: 0kgN; NT2: 20 kgN; NT3: 40 kgN; NT4: 60kgN and NT5: 80kgN/ha/harvest. Each formula was tested with 5 replicates which were arranged in a completed randomized block design. Results showed that when N fertilizer levels increased from 0 kgN to 80 kgN/ha/harvest then foliage dry matter (FDM) yield, the FDM yield of NT1, NT2, NT3, NT4, NT5 were increased by 6.528, 7.219, 7.888, 8.455, 8.698 tons/ha/year, respectively and so crude protein yield (CP), the CP yield from NT1 to NT5 was increased by 2.094, 2.366, 2.642, 2.895, 3.061 tons/ha/year, respectively. CP level in foliage dry matter was increased from 32.07% to 35.19%, whereas crude fibre (CF) level in FDM was decreased from 9.94% to 7.32%. Based on FDM yield, level of CP, CF in FDM and statistical analysis for these criteria, it is recommended that N application for *Moringa oleifera* fodder should be at 40kgN/harvest or above, and the most suitable level should be 60kgN/ha/harvest.

Keywords: *N level, Yield, Quality, Moringa oleifera.*

EVALUATION OF PLANTING TIME ON TUBERIZATION AND TUBER YIELDS OF FOUR CASSAVA VARIETIES (MANIHOTESCULENTACRANTZ) IN THE LOWVELD OF ZIMBABWE

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Abstract

Cassava (*Manihot esculenta* Crantz) is cultivated for its large starchy storage roots. Understanding root tuberization is essential to secure future yields for farmers. Field experiments were conducted to evaluate time of planting cassava in semi-arid regions of Zimbabwe. Four cultivars of cassava were used M 7; XM 6; MBU/52/B2 and TME 12. Three planting dates, first week of January (mid-summer), first week of May (winter) and first week of September (early summer) were evaluated. Mature cassava cuttings 20 cm long were used as planting materials planted at an angle (slanting). Results showed that planting the first week of January gave significant ($p < 0.001$) larger diameter of tubers at 91st day after planting. The four cultivars did not show any significant tuber diameters at 35th, 49th, 63rd and 77th days after planting. Tuberization started 63 days after planting in January and September, whilst in May it started 77 days after planting. Cultivar M7 gave significant thicker tubers $p < 0.001$ at 91st day after planting. Tuber formation and development was significantly slow ($p < 0.001$) with May planting. Cultivar MBU/52/B2 gave significant low tuber yields with May planting compared to other cultivars. Tuber yields at 12 months after planting showed that January planting gave significant ($p < 0.019$) higher yields for both fresh and dry yields.

Key words: *Cassava, planting time, tuberization, cultivars, yield.*

IMPROVING POSTHARVEST QUALITIES IN TOMATO VALUE CHAINS: IMPACT OF CULTIVAR TYPES AS QUALITY INDICATORS

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Abstract

Tomato (*Lycopersicon esculentum*) is one of the major horticultural crops grown in many parts of the globe. Production of over 120 million metric tonnes is estimated. Yet due to its perishability rate and susceptibility to mechanical damage during handling and transportation most tomatoes do not get to the end user or they do with poor quality. Tomato has more varieties sold globally than any other vegetable crop. Tomatoes are produced in all Zimbabwean provinces with Mashonaland east (Macheke, Mtoko,Domboshava) and Mashonaland central (Shamva, Bindura and Mazowe) being highest producers. Production is limited in winter months as they can only be produced in frost free areas. Fruit quality is highly linked to the ability of the cultivar to maintain certain postharvest qualities such as lower weight loss, few fruit cracks and less decay incidence. Tomato is an important ingredient in diets across all regions in the world. The aim of this paper is to determine the postharvest qualities of 5 tomato varieties grown in Zimbabwe. There are no significant differences on postharvest qualities of different tomato varieties.

Keywords: *postharvest, tomato, Zimbabwe.*

EVALUATION OF SOME INTRODUCED TOMATO (*SOLANUM LYCOPERSICUM*) CULTIVARS IN ZIMBABWE

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Abstract

Tomato (*Solanum lycopersicum*) is one of the most consumed vegetable worldwide becoming a main supplier of several important nutritional value to human diet. It is rich in Vitamin A, C and other minerals. Tomato can be classified as a vegetable or grouped as a botanical fruit. In Zimbabwe it is mostly eaten in stews, soup, mixed with leaf vegetables, sliced in salads and also processed in sauces and puree. Yields of tomato varieties in Zimbabwe remains comparably low compared to what is pertaining to other countries. A good yielding tomato variety with a good shelf life on average ± 7 days can help ensure the improvement in the livelihood of tomato farmers. Introduction of new varieties is essential in identifying varieties with best attributes for production by farmers. The objective of the study was to assess some introduced varieties of tomato in order to select promising types for cultivation. A field experiment was conducted at Horticulture Research centre in Marondera, Zimbabwe using 11 varieties introduced from China and India as well as two local checks (Rodade and moneymaker). The experiment was a randomised complete block design with three replications. Data was collected on plant vigour, flowering dates, and number of marketable and non- marketable fruits, average fruit weight, and total marketable weight.

Key words: *Tomato, adaptability, yield, introduced varieties.*

CHEMICAL EMASCULATION IN GERMAN CHAMOMILE - CULTIVAR 'MANZANA' EXHIBITS BEST FEMALE RESILIENCE

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Abstract

For hybrid breeding of hermaphroditic plants, male sterile mother lines are indispensable. Chemical emasculation is a common approach to reach this aim. Gametocides should effectively reduce or disable pollen fertility, without negatively affecting female fertility or exhibiting phytotoxic effects. Analysis of a split plot experiment of 100 individuals of four accessions of German chamomile ('Bona' (BON), 'Degumille' (DEG), 'Manzana' (MAN), and 'Hungarian 2' (HUN2)), treated with four chemical gametocides (1-naphtaleneacetic acid (NAP), ethephon (ETH), gibberellic acid (GIB), and 2,3,5-triiodobenzoic acid (TRI)) vs. control, presented effects on pollen sterility (PS), seed set, germination rate and whole-plant-damage. TRI caused the highest PS (43%, $p < 0.05$ against ETH 17.95%). MAN numerically developed the best seed set (mean number of fertile seeds/capitulum, 12.39 vs. total mean 6.71). Tentatively, MAN exhibited the best germination rate of seeds, despite of gametocidal applications targeting male fertility (mean 13.47% after two weeks vs. total mean 6.81%, $p = 0.061$). All gametocides caused general plant damage ($\chi^2 = 7.679$, asymptotic $p = 0.104$), but MAN was the least damaged (8%) and DEG was the most affected (48%) accession ($\chi^2 = 13.721$, asymptotic $p = 0.003$). The tested gametocides in our study cannot be recommended for German chamomile, but the tetraploid cultivar MAN exhibited the best female fertility, and at the same time, the least whole-plant-damage, despite of gametocidal treatment.

Keywords: *Matricaria recutita*, gametocide, pollen, male sterility, female fertility.

INFLUENCE OF DIFFERENT AGROTECHNOLOGY ON MACRO AND MICRONUTRIENTS ACCUMULATION IN *CANNABIS SATIVA L.* MORPHOLOGICAL PARTS

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Abstract

Plants are valuable and natural resources because they can provide us with the chemicals that humans need. *Cannabis sativa L.*, also known as fibre hemp, is one of the oldest cultivated and herbaceous plants in the world, with many valuable natural components used by people since ancient times. Hemp plants are rich in nutrients and health-enhancing ingredients, including vitamins, mineral salts and macronutrients, and at least one hundred different cannabinoids. Deficiency of mineral nutrients such as Fe, I, Zn, Ca, K, Mg is a growing nutritional problem in human populations. The versatility of hemp leaves and stems and the composition of their components can lead to the sustainable development of many products for use in the food, cosmetic and medical industries. In order to promote environmental-friendly and sustainable agricultural systems, fibre hemp has been reintroduced in both conventional and organic cropping systems in the last years, because it may reduce cereal monocropping, preserving soil fertility, and it is suitable for innovative industrial applications (i.e. biocomposites in automotive and constructions industries, raw materials for thermal insulation, oil and agro-fine chemicals, etc.). This study aimed to find out the amount of mineral composition of hemp morphological parts (*Cannabis Sativa L.*) during vegetation by means of inductively coupled plasma mass spectrometry (ICP-MS) method. In the present study, 3 hemp (variety Felina 32) raw materials (stems, leaves and blossoms) were analyzed. Samples were collected from Institute of Agriculture (LAMMC) field experiments. Investigated samples differ in their growing conditions. Different fertilization rate and density were applied. Mineral composition of digested hemp samples was investigated by means of ICP-MS method. Obtained results, as well as sample preparation methodology step by step, will be presented at the conference.

Keywords: *fibre hemp, macro and micronutrients, hemp morphological parts.*

VARIABILITY OF STEM HEIGHT IN WHEAT *TRITICUM AESTIVUM* L.

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Abstract

The stem height of wheat has impact on grain yield. Variability of height of wheat stem depends from environment and genetic structure of varieties. The aim of this study was estimation of impact of genetic components and environmental conditions on variability of stem height in 10 genetically divergent wheat varieties. The experiment was set up as a randomised block design in three replications. Obtained results indicated differences in average values of stem height among tested wheat varieties in each year of experiment. In the first year of study, the least stem height had Danica variety (44.87 cm) and the highest stem height had wheat variety Ljubičevka (64.73 cm). In the second year stem height varied between 64.37 cm in Danica variety and 87.97 cm in Šumadija variety. In average for all varieties the height of stem was higher in the second year than in the first year of experiment. Also, in average the value of height of stem was higher in second year than in the first year, in all analysed wheat varieties. The highest height of stem, expressed Šumadija variety in average (87.97 cm) in the second year. The least value of stem height (44.87 cm) in average had Danica variety in the first year of experiment. Based on the results significant differences between the wheat varieties according to stem height was established and impact of genetic factors prevailing compare to impact of environmental factors.

Keywords: *wheat, variability, height of stem, varieties.*

AN INSIGHT INTO THE CHEMICAL COMPOSITION AND BIOMEDICAL POTENTIAL OF GRAPESEED OIL-COLD PRESSED

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Abstract

The production of grapeseed oil-cold pressed oil (possessing numerous biologically active compounds of relevance for health and nutrition) is fully justified both in terms of economy and ecology – in brief, the grape seeds are broadly considered as a by-product of the fruit processing. This vegetable oil (making 13-18% of the seed's content), enriched in the unsaturated fatty acids essential for humans, is widely recognised for its lively colour, aroma and taste. Linoleic (over 70%) and oleic (about 15%) acids are predominant fatty acid compounds, followed by linolenic acid (approximately 1%). In comparison, the content of the saturated fatty acids usually reaches around 10%. Tocopherols (α - 10 mg/100 g; β and γ - 15 mg/100 g) and tocotrienols (mostly γ) also contribute to the oil's composition. While the most common sterol is β -sitosterol (67-70%), campesterol, stigmasterol and avenasterol may be present at a smaller scale. Finally, polyphenolic compounds (or, simply, polyphenolics) are worth mentioning herein, too. Such an unique chemistry does provide a lot health benefits, in particular, towards heart disease. More precisely, the risk of cardiovascular disease can be reduced up to 55% by the oil's proper (adequate) use. Additionally, the cancer patients are likely to profit on its enormous biopotential with a clear stress on the antioxidant effects.

Keywords: *Grapeseed oil, Secondary metabolites, Health value.*

SEVENTY-FIVE YEARS OF BREEDING AT THE MAIZE RESEARCH INSTITUTE, ZEMUN POLJE (SERBIA)

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Abstract

Maize breeding has been successfully performed at the Maize Research Institute, Zemun Polje for the past 75 years. The Maize Research Institute, Zemun Polje is one of the leaders in the international market and has a thriving cooperation with more than 20 countries worldwide. The decades-long work on breeding at the Institute has been based on the improvement and development of breeding methods and materials, and the implementation of modern scientific achievements. The multidisciplinary scientific staff and the application of the up-to-date technologies resulted in over 730 maize hybrids of various FAO maturity groups (FAO 100-800) released in Serbia and over 130 maize hybrids released abroad. Maize gene bank has also contributed to the development of such a large number of hybrids. At the same time, the gene bank is a permanent source of new germplasm. Furthermore, it is also a source of traits of agronomic importance, tolerance to drought, types of cytoplasmic male sterility. The process of maize breeding has been accelerated due to the constant advanced training of scientists and the introduction of the latest technologies. SSR markers have been used for a long time for the prediction (determination of the genetic distance) aimed at the increase of preciseness and shortening of the time necessary for the development of parental components (inbred lines). In recent years, the latest technologies, such as SNP (Single Nucleotide Polymorphism) chips have been used at the Maize Research Institute, Zemun Polje. Since 2014, a double haploid (DH) technology has been used. During that time over 7000 inbred lines were derived. The cooperation with the renowned company BASF resulted in the development of hybrids resistant to the herbicide Focus ultra (a.i. Cycloxydim). The programme for the development of hybrids with improved grain quality has been initiated: red- and blue-seeded maize hybrids and hybrids of high grain quality (*QPM*). The small grains breeding and selection programme has been initiated 12 years ago and there are nine varieties released both in Serbia and abroad. In addition to maize and small grains, soya bean has been also bred and there are nine cultivars released in Serbia and three cultivars are in the process of releasing in the European Union.

Keywords: *maize, breeding, soya bean, small grains.*

NOVI SAD SCHOOL OF GENETICS – THE PILLAR OF AUTOCHTHONOUS PLANT BREEDING PROGRAM

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Abstract

Genetics is the oldest subject of human contemplation, and one of the youngest scientific disciplines, a bit more than 150 years old. However, genetics is one of the fastest growing fields of human activity in history. From Mendel's 3:1 segregation ratio to human genome sequencing completion 140 years passed. Today, genetics is a scientific field that is thought to mark, if not millennium, at least its first century. Genetics largely contributed to Green Revolution in mid-1950s, the industrialization of agricultural production, and was a scientific battlefield during the Cold War after WWII. In this whirlwind of events during the second half of the twentieth century in Novi Sad (Serbia), a proliferate Plant Breeding Program has been established, as well as, a Chair of Genetics and Plant Breeding at the Faculty of Agriculture. A hallmark of NSSG has been openness to theories and views, and a course between East and West genetic and evolution dogmas. Accepting the best from both sides, joining and combining it, a broad view on inheritance has been developed, serving as a corner stone for autochthonous plant breeding program. The result of this work is self-sufficiency in main crop production, particularly in wheat, with more than 1500 varieties and hybrids of wheat, maize, sunflower, soybean, etc., thousands of students, PhDs, scholars and university professors, as well as, competence and readiness to fully participating in fulfilling an immediate and crucial task to meet the nutrition requirements of more than 9 billion souls expected by 2050.

Key words: *Heredity, Genetics, Breeding, Crops, Agriculture.*

NUTRIENTS AND BIOACTIVE COMPOUNDS OF ALMONDS

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Abstract

The almond *Prunus amygdalus* L., is a species that belongs to the *Amygdalus* subgenus inside the *Prunus* genus, the *Rosaceae* family and the order *Rosales*. It is written in a Bible that sweet almond is one of the oldest cultivated fruit species. It is well adapted and spread throughout the whole Mediterranean region from which 28% of the world production is obtained. Almond is among the most popular tree nuts produced and consumed worldwide as a good dietary source of protein, monosaturated fatty acids, dietary fiber, vitamin E, riboflavin and essential minerals (manganese, magnesium, copper and phosphorus). Daily consumption of 30-50 g of almonds provides macronutrients, micronutrients, and phytochemicals of high biological value. These bioactive compounds have a synergistic effect in preventing and delaying many age-related pathologies (e.g. cardiovascular diseases, stroke, type 2 diabetes mellitus, certain types of cancer, and several neurodegenerative diseases). The consumption of almonds has been scientifically proven to improve life span and health span and should be a part of a healthy diet. The objective of this review was to summarize the latest information of almond nutrients and bioactive compounds so as effect of processing on changes of nuts properties. Health benefits of almond intake were also discussed. Several factors affected the nutritional quality of almonds, including genetic and environmental factors. In addition, the form of consumption additionally changes composition of almonds. The roasting process induced chemical and microstructural changes, especially altering the lipid composition, favoring its oxidation and modifying antioxidant compounds. The major health benefits of almonds were related to its beneficial impact on lipid profile. Around 90% of the lipids were in the unsaturated form which were cardio protective by decreasing low-density lipoprotein (LDL) cholesterol and mildly increasing high density lipoprotein (HDL) cholesterol.

Keywords: *almond, consumption, kernel, health benefits.*

THE ROLE OF WHEAT-RYE TRANSLOCATION 1Bl.1Rs IN WHEAT BREEDING PROGRAM DEVELOPMENT OF NOVI SAD (SERBIA)

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Abstract

In the second half of 1950's, a plan to make Yugoslavia self sufficient in main crop production included all the plant breeding institutions all over the country. The Institute for Agricultural Research in Novi Sad, Serbia (today Institute for Field and Vegetable Crops Novi Sad - IFVCNS) was one of the scientific institutions included in this program. The wheat, as the main bread making crop, had a particular place in the State project. For the next 30 years the task had been not only fulfilled, but also surpassed, by far. The IFVCNS developed a very successful wheat breeding program, creating a number of high yielding, quality wheat varieties. Wheat-Rye translocation 1Bl.1Rs played a notable role in obtaining desirable genetic variability in wheat. A sample of 139 varieties of common wheat (*Triticum aestivum* L.), predominantly Serbian winter wheat varieties originated in the Institute of Field and Vegetable Crops in Novi Sad, has been examined for presence of 1Bl.1Rs wheat-rye translocation. Two large groups consisting of varieties possessing and lacking the translocation, have been compared for 20 traits and grain yield. Grain physical, chemical and technological properties, as well as, rheological results of dough, and bread baking parameters were studied. The influence of 1Bl.1Rs translocation was also studied in a light of wheat seed storage protein quality genetic background composition. Genotypes with and without translocation differed in observed values for the studied traits. These effects were slightly modified depending on the examined quality genetic background.

Key words: *1Bl/1Rs, translocation, wheat, rye, breeding.*

A RESEARCH ON DETERMINATION OF PHENOLOGICAL AND GENETIC VARIATIONS IN WALNUT SEEDLING GENOTYPES

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Abstract

This research was carried out to determine phenological and genetic differences of the genotypes obtained from the free dusting in the Maras-18 walnut cultivar and the main cultivar (Maras-18). In order to determine the phenological differences between the main plant and genotypes, traits such as budburst, first foliation, leaf yellowing and defoliation dates periods were investigated. 12 ISSR primers were used to determine genetic variations. Among the phenological characteristics examined in the study, the budburst, first leafing, leaf yellowing and defoliation dates periods were found 45 days, 45 days, 31 days and 43 days, respectively. The variation rate between the main cultivar and genotypes was 91.25% for bud burst, 90% for the first foliation, 100% for leaf yellowing and 92.5% for defoliation, while the average phenological variation was 93.43%. From the genetic analysis, 29 bands were obtained in total. 26 of these bands (89.6%) were polymorphic with the average number of alleles of 4.33. Most bands obtained from ISSR 5 and ISSR 12 were primer. According to genotypes, Polymorphism Information Content (PIC) value ranged from 0.21 to 0.98, and the mean PIC value was calculated as 0.63. From clustering analysis, the genotypes were clearly divided into 2 main clusters. This present research indicated that the genotypes had phenologically and genetically important variations when compared with the main cultivar. The results also showed that the use of phenological and molecular data together in the management of gene resources were important. In addition, ISSR marker techniques were confirmed as an effective method to determine genetic differences in walnut genotypes

Key words: *Walnut, Juglans regia L., phenological, molecular, ISSR.*

EFFECT OF DIFFERENT CUTTING INTERVALS ON THE FORAGE YIELD AND SOME SILAGE QUALITY CHARACTERISTICS OF GIANT KING GRASS (*Pennisetum hybridum*) UNDER MEDITERRANEAN CLIMATIC CONDITIONS

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Abstract

This study was conducted in Bornova experimental fields of Department of Field Crops, Faculty of Agriculture, University of Ege, Turkey during 2015 and 2016, in order to determine the effect of different cutting intervals (30-, 60-, 90-, 120-, 150- and 180- days) on the forage yield and some quality properties of giant king grass (*Pennisetum hybridum*). Paraíso cultivar of giant king grass (GKG) was used as crop material. Some characteristics were measured such as dry matter (DM) yield, concentrations of crude protein (CP), NDF and ADF. Results indicated that there were significant effects of cutting intervals on the yields and some silage quality characteristics of GKG, and, CP content decreased as inter-cutting interval increased. It was recommended that the production of GKG using 60- day intervals were the most successful cutting frequency regarding the forage yield and quality to the regions with Mediterranean-type climates under irrigation.

Keywords: *Pennisetum hybridum*, cutting interval, DM yield, forage quality.

A PRELIMINARY STUDY ON THE EFFECT OF DIFFERENT NITROGEN LEVELS ON THE YIELD AND SOME YIELD CHARACTERISTICS OF FODDER BEET (*Beta vulgaris* var. *rapacea*)

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Abstract

Production of forage crops is very important for livestock production in the world and forage crops growing rate should be increased in the crops cultivation. A pot study was conducted at Ege University, Faculty of Agriculture, Department of Field Crops, Izmir/Turkey, from October 2017 to May 2018, to investigate the effect of nitrogen levels (0, 30, 60, 90, 120, 150, 180 and 210 kg N ha⁻¹) on the yield and some yield traits of a fodder beet (*Beta vulgaris* var. *rapacea* Koch.) in the outdoor conditions. The experiment was arranged as a completely randomized block design with four replications. Leaf length and weight, tuber length-diameter-weight, tuber sugar content and dry matter content were studied in this study. Results shown that rates of nitrogen had a significant effect on the entire measured yield and the yield components of fodder beet. In the Mediterranean ecological conditions of Izmir, the best yield in fodder beet was obtained by application of 120 kg ha⁻¹ of nitrogen.

Keywords: *Fodder beet, nitrogen level, livestock and tuber weight.*

MECHANIZATION OF HEMP HARVEST AND ITS IMPORTANCE

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Abstract

Hemp (*Cannabis sativa* L.) plant components are evaluated in different ways in the industrial and textile fields. There are factors that limit the commercialization of hemp in the agro-industrial chain. From an agricultural point of view, deficiencies in harvesting methods are important among these factors. Often, solutions to these problems in harvesting methods have been tried to be found with local agricultural practices. Harvest time is important in hemp because late harvest should not be done. Delayed harvesting leads to increased sap yield, but to decreased fiber yield and quality in the plant. Therefore, hemp reaching harvest maturity should be harvested as soon as possible. Hemp harvesting is usually done by hand, but in recent years the method of machine harvesting has also been used. Harvesting by hand causes too much labor and time to be wasted. As a result of the surplus labor requirement, the chances of competition against other fibrous plants decreased and the cultivation area decreased in many countries. For this reason, especially machine harvesting has increased its importance day by day. Hemp harvesting has developed on a local basis. However, research is still ongoing on harvesting machine where fiber quality will be maintained and seed loss will be minimal in existing harvesters. In particular, hemp harvesting mechanization focuses on reducing the losses in the mowing patterns of harvesters and increasing labor efficiency. The aim of this paper is to present a review of the existing the current mechanical harvesting systems for Hemp, one of the most efficient fiber plants, and to provide information about the machines that need to be worked on.

Keywords: *Hemp, fiber, mechanization, harvesting, harvester.*

**SURFACE-STERILIZATION EFFECT ON SEEDLING GROWTH AND
REGENERATION CAPACITY OF SAINFOIN (*ONOBRYCHIS VICIIFOLIA* SCOP.)
UNDER *IN VITRO* CONDITIONS**

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Abstract

Surface sterilization is the first step of tissue culture studies. Disinfectant concentration, temperature and sterilization period which are used in seed surface sterilization, affect the vitality of seedlings and thereby regeneration capacity of explants significantly. On one hand, surface-sterilization process aims to eliminate all microorganisms that can easily grow *in vitro* conditions; on the other hand, it should guarantee the explant's viability and regeneration capacity. The aim of this study was to determine the effects of different concentrations (20, 40, 60, 80 and 100%) and temperatures (10°C, 20°C and 30°C) of commercial bleach containing 5% sodium hypochlorite (NaOCl) on *in vitro* seed germination, seedling growth and regeneration capacity of sainfoin (*Onobrychis viciifolia* Scop.) hypocotyl explants. Results showed that surface-sterilization process affected *in vitro* seed germination and seedling growth and subsequent regeneration capacity of explants. All parameters were negatively affected by concentrations of commercial bleach over 40% and temperatures over 20°C while the best results with respect to *in vitro* seed germination and seedling growth percentages, hypocotyl and seedling lengths, shoot regeneration percentage, shoot number per hypocotyl, total shoot number per Petri dish, regenerated shoot length and total chlorophyll content were obtained when sainfoin seeds were surface-sterilized with 40% commercial bleach at 20°C for 30 min. following a pretreatment with 95% ethanol.

Keywords: *Sainfoin, Surface-Sterilization, Seedling Growth, Regeneration.*

CHARACTERIZATION OF LOCAL SOUR CHERRIES FROM ARTVIN PROVINCE IN TURKEY

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Abstract

The production and consumption of cherries has increased recently due to consumer awareness of their health benefits, since they are rich in polyphenolics (namely anthocyanins and hydroxycinnamic acids). Global sweet cherry production increased over the last 16 years from 1.9 to 2.32 million tons, with Turkey, USA, Iran, as the main producers. Sour cherry production has been static during the same period at around 1.1–1.3 million tons concentrated in Europe, with the Turkey and Russian Federation are the predominant producer. Coruh valley located Northeastern Anatolia in Turkey and it is famous area in the world in terms of plant biodiversity. Local sour cherry trees and shrubs could be found each points of the valley and sour cherry fruits contribute livelihoods of the local communities peoples. Seed propagated sour cherries also an important part of biodiversity of the valley. In this study we sampled twenty sour cherry fruits from Ardanuc town belongs to Artvin provinces and some phenotypic traits such as harvest date, fruit mass, flesh ratio, fruit color, fruit juice color and biochemical characteristics such as specific sugars, organic acids, antioxidant capacity, total anthocyanin, total phenolic and vitamin C content were determined. Sour cherry genotypes harvested between 23 June and 10 July but the majority of the genotypes harvested between 25 and 30 June. The genotypes had average fruit mass between 2.34 g and 3.42 g. The majority of genotypes had red fruit skin color and followed by dark red fruit skin color. Fruit flesh ratio of local sour cherry genotypes were ranged from 84.70 to 90.20%. Local sour cherry genotypes were found to be rich source of bioactive content and total phenolic content were in range of 256 to 328 mg gallic acid equivalent per 100 g. Total anthocyanin content were also differed significantly among genotypes which were found between 114 to 189 mg cyanidin-3-glucosylrutinoside equivalent per 100 g fresh samples. Sucrose and glucose were found to be the major sugars in local sour cherry fruits.

Keywords: *Local fruits, Sour cherry, Characterization, Germplasm.*

MORPHOLOGICAL AND BIOCHEMICAL DIVERSITY AMONG 'BEYAZ TURFANDA' GRAPE CLONES

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Abstract

Grapevine is an ancient agricultural crop, yet despite the massive advances in cultivation and domestication, many of the commercial varieties that make up the bulk of the international wine and fresh market have been in production since the Roman times. Coruh Valley is rich in terms of grape biodiversity and grape varieties grown in valley stand out with its different taste and thin peel traits due to different climatic condition of the valley. The main grape variety in the valley is 'Beyaz Turfanda' and the vineyards include this variety approximately %95 ratio. The variety has big berry and cluster size. It is observed that diverse 'Beyaz Turfanda' clones in Yusufeli district in Coruh valley has been appeared during long growing period. In this study 10 'Beyaz Turfanda' clones were selected and evaluated according to berry weight (g), cluster size (cm²), cluster length (cm), cluster width (cm), Soluble Solid Content (SSC), pH, acidity and vitamin C. Results showed diversity for both morphological and biochemical parameters among the 'Beyaz Turfanda' clones. The clones showed cluster size between 195 cm² and 253 cm².

Keywords: *Grape, diversity, cluster, berry.*

A PRELIMINARY STUDY ON THE EFFECT OF DIFFERENT PHOSPHORUS LEVELS ON THE GRAIN YIELD AND SOME YIELD CHARACTERISTICS OF HORSE BEAN (*Vicia faba* var. *minor*)

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Abstract

Horse bean (*Vicia faba* var. *minor*) has potential as a source of nutrition for animal feed, and as a N₂ – fixing. It also plays an essential role in enhancing soil fertility. Phosphorus is major nutrient elements for grain legumes. Legume crops can be quite responsive to P fertilization, particularly; where soils are low in available of P. The application of optimum level of phosphorous has an important role in getting high grain yield of horse bean. This study was conducted to determine the effect of phosphorus levels on the grain yield and some yield parameters of horse bean (Jasny cv.). The experiment was carried out at Ege University, Faculty of Agriculture, Department of Field Crops, Izmir/Turkey, from October 2016 to June 2017 as a pot experiment grown outdoor. In the experiment, horse bean seeds were sown with different fertilization levels of phosphorus (0, 20, 40, 60, 80, 100, 120 and 140 kg P ha⁻¹). Rate of phosphorus had a significant effect on all of the measured traits and the grain yield of horse bean. Application of phosphorus at the rate of 100 kg ha⁻¹ can be recommended for obtaining the maximum grain yield in horse bean under Mediterranean ecological conditions of Izmir.

Keywords: *Horse bean, phosphorus level, harvest index and grain yield.*

PERFORMANCE OF SWEET SORGHUM (*SORGHUM BICOLOR VAR. SACCHARATUM*) AFFECTED BY NITROGEN MANAGEMENT IN SUSTAINABLE FORAGE CROPS CULTIVATION

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Abstract

Sweet sorghum (*Sorghum bicolor var. saccharatum*) is mainly planted for forage and sugar (ethanol) production. It is well adapted to sub-tropical and temperate regions, being highly biomass productive and water efficient. Recently, a great deal of research has been undertaken in almost every country of the world to explore sweet sorghum's biomass productivity and energy potential under various environmental conditions and cultural practices. A pot experiment was conducted to determine the effects of nitrogen levels on the forage yield and some quality components of sweet sorghum (*Sorghum bicolor var. saccharatum*). The experiment was carried out at the Bornova experimental fields of Field Crops Dept. of Agriculture Fac., Ege Univ., Turkey, during 2019-second crop growing season. The experiment was laid out in randomized complete block with four replicates. Seven nitrogen levels (0-50-100-150-200-250-300 kg N ha⁻¹) were tested on sweet sorghum cv Sugar-drip. Results indicated that the effects of N treatments on plant height, dry matter (DM) yield and cell wall components were significant. Moreover, application of the higher rates of N treatments increased the yield and yield components compared to the control treatment. The highest DM yield and acceptable content of cell wall components were obtained with the application of 200 kg ha⁻¹ N in sweet sorghum under second crop production system.

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

DOES WHEAT SUPPRESS COTTON GROWTH IN RELAY STRIP INTERCROPPING SYSTEM?

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Abstract

Decreasing agricultural areas is one of the sources of concern all over the world. It is predicted in future scenarios that many strategic crops such as cotton will compete with staple crops such as wheat due to lack of agricultural areas. Furthermore, relay strip intercropping of wheat and cotton is considered as outstanding system in terms of land use productivity and it was adopted by farmers especially in China. However, it has negative effects to growth of cotton during intercropped period and it is needed to be focused on mitigation of these negative effects. For this purpose, cotton growth suppressed by shading of wheat was examined in this study. The study was comprised of four replications and two factors. These factors were cropping systems (sole cropping and intercropping of wheat and cotton) and sowing directions (north-south and east-west). We measured leaf greenness, canopy temperature, leaf area, dry matter and photosynthetic active radiation on cotton plants in order to quantify negative effects of wheat. As results of study, growth of intercropped cottons under shade of wheat were generally diminished according to calculated growth parameters such as crop growth rate (39%) and net assimilation rate (15%). This decrease could have been triggered by change on leaf morphology. Intercropped cotton plants were acclimated to low light conditions by increasing specific leaf area (33%) and this meant that leaf thickness were decreased. Additionally, after harvest of wheat, intercropped cottons were exposed to fully sunlight and specific leaf area decreased in 61%, canopy temperature depression decreased in 60% and SPAD increased in 9%. As conclusion, it was suggested that adaptation of cotton to low light conditions seemed to be related to change in leaf morphology.

Keywords: *Relay strip intercropping, Cotton, Wheat, Leaf morphology.*

IN VITRO REGENERATION OF OCIMUM MINIMUM L.

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Abstract

Ocimum minimum L. is a plant belonging to Lamiaceae family, annual, herbaceous, being able to reach up to 30 cm in height, having green stem and leaves, white flowers and black seeds. In the study, seeds of *Ocimum minimum* L. were placed in sterile bottles having 40% commercial bleach (5% sodium hypochlorite) and were shaken for 10 min at room temperature. This was followed by 3-4 washes with sterile distilled water. Sterilized seeds were germinated on a basal medium of Murashige and Skoog's (MS) mineral salts and vitamins, 3% sucrose, and 0.7% agar in Magenta vessels (15×15 cm). Axillary meristem explants were excised from 4-week-old sterile seedlings. For shoot regeneration, axillary meristem explants were cultured for 3 weeks on MS medium supplemented with different concentrations of BAP (2, 4 and 6 mg l⁻¹) and 0.05 mg l⁻¹ NAA. All cultures were incubated under a cool white fluorescent light (27 µmol m⁻² s⁻¹) with a 16 h light/8 h dark photoperiod in a growth chamber at 25±1°C. Shoot regeneration percentage, shoot number per explant and total shoot number per Magenta vessel were recorded 3 weeks after culture initiation. Regenerated shoots were transferred to Magenta vessels (15x15 cm) containing 100 ml MS medium; they were incubated for two weeks at 25±1°C to induce root formation. Rooted shoots were then transferred to pots in a growth room for two weeks where light, temperature and humidity were controlled. Humidity was decreased gradually from 100% to 40% during two weeks for acclimatization of seedlings. After two weeks, plantlets were moved to a greenhouse. In the study, five replicates were used. The highest results with respect to regeneration percentage, shoot number per explant and total shoot number per petri dish were obtained from the medium having 4 mg l⁻¹BAP and 0.05 mg l⁻¹ NAA.

Keywords: *Ocimum minimum*, *Regeneration*.

FLOWERING, POLLINATION AND FRUITING OF SOME INTRODUCED OLIVE CULTIVARS IN AL-JOUF REGION IN SAUDI ARABIA

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Abstract

The expansion of the olive cultivation resulted in the north of the Kingdom of Saudi Arabia (KSA) to import many cultivars from several countries and planted, which requires the study of the impact of environmental conditions on these cultivars and their success. The aim of this study was to evaluate the important olive cultivars introduced recently for cultivation in the North Kingdom of Saudi Arabia. These cultivars are Manzanilla, K18, Sourani, Nabali and Picual growing in the project of the Al Jouf Agricultural Development Company in Bosita, Ten trees (as a replicates) were selected of similar size and age (about 10 years) from each cultivar. The tested trees received the same agro- technical practices adopted in this district. The following characteristics were studied: flowering and fruiting the results of the study show that the species differed among themselves in a lot of floral traits and fruiting. Picual was an outstanding first qualities crop (fruits, oil) for the tree with the qualities of a good fruiting making it the best cultivars for the extraction of oil as well as excellence cv. Manzanilla qualities of fruits and this makes it even better for dual- purpose items and was a cv. Sourani best by the oil in the fruit so it is recommended to these three cultivars of superiority over the rest of the cultivars, it can also take advantage of the cultivars of k18 and indifferent of Nabali for pickling.

Keywords: olives, new varieties, characteristics.

2. PLANT PROTECTION AND FOOD SAFETY

WEED-CROP COMPETITION UNDER CONDITIONS OF CLIMATE CHANGE

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Abstract

Plants with C₃ photosynthetic pathways (PP) are estimated to advantage more than C₄ in conditions of elevated CO₂. From this perspective, higher photosynthetic rate at increased CO₂ in C₃ crops and C₃ weeds suggest more positive respond to higher CO₂ levels than the C₄ crops and C₄ weeds. The unlike reactions of C₃ and C₄ plants to rising CO₂ are particularly important to weed-crop competition in agriculture production. Nevertheless, only the competition C₃ crop : C₄ weed enlarged with the higher CO₂ levels. Positive effects of raised CO₂ for weeds and crops may be probably nullify at higher temperatures. In conditions of higher temperature, plants with C₄ PP (generally weeds) will show higher competitive capacity compared to C₃ PP (generally crops). This might provide suitable conditions for more vigorous growth of some weeds, which are currently limited by low temperatures, whereas the spread of some tropical and subtropical C₄ weeds might shift northwards. The mutual effect of elevated CO₂ and temperatures increases the competitiveness of C₄ weeds in compare with C₃ crops and weeds. In addition, rainfall shortage and prorogated drought will limit growth of crops, resulting in scarcity of crop plants cover and bare soil, thus permitting emergence of more drought-tolerant weeds. Reduction in plant growth as a result of low nutrient accessibility is often stressed as a reason for negation of beneficial effects of elevating CO₂ level. Mutual effects of soil water and nutrient shortage result in reduction of the positive effect of C₃ plants to elevated CO₂, but it does not affect C₄ plants, particularly C₄ weeds.

Keywords: *Climate change, Weed-crop competition, C₃ plants, C₄ plants.*

ASSESSMENT OF CONTROL STRATEGY BY SPRAYING LOW DOSES OF SUGARS ON APPLE ORCHARD AGAINST *CYDIA POMONELLA* (L.)

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Abstract

Codling moth is the most serious pest of apple worldwide. Its control still relies largely on insecticide applications, faced with this situation; it becomes essential to design biological control systems to minimize chemical treatments. In this study, in an orchard located in Beni Fedhala province (Batna-Algeria), test results compare the effect of spraying, fructose (100 ppm), glucose (100ppm), and insecticide (Deltamethrine) on the Golden Delicious variety against *C. pomonella* larval damages. The results of this study show that codling moth own four generations in study area. It is a very important pest with about $59.19\% \pm 1.15$ of damaged fruits at harvest. The spraying of glucose alone, fructose alone and the chemical insecticide alone causes a significant increase in the percentages of healthy fruit at harvest compared to untreated control. The use of fructose and glucose has significantly reduced the percentage of damaged fruits at harvest followed by the spraying of the insecticide which produces the lowest percentage. The Abbott efficacy of glucose treatments is $23.75\% \pm 2.6$ compared to the insecticide $37.6\% \pm 2.55$; and fructose 15.54 ± 3.01 . The use of sugars is a completely innovative way in the field of plant protection. These first results demonstrate a promising alternative to conventional programs.

Keywords: *Cydia pomonella* L., glucose, fructose, Golden Delicious.

***ENTEROBACTER SAKAZAKII*: POTENTIALLY PATHOGENIC COLIFORM SPECIES**

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Abstract

Enterobacter sakazakii species is responsible for various human diseases such as meningitis, sepsis, necrotizing enterocolitis, cerebral abscess, sequelae such as quadriplegia. The first epidemic was reported in 1958 and cases of neonatal meningitis in 1961. Recently, the US - FDA staff worry about the increased incidence of infant related infections. Study aimed to establish critical review thorough analysis of species systematic, bacteriological data and enumeration/isolation technics in food and environment microbiology field, to review the recent recommendations from the relevant international organizations (Codex Alimentarius, FDA, ISO, AFNOR, FAO, WHO). Ecology species is not limited to infantile milk and preparations. Ubiquitous, it is present in wide range of food, water, utensils, prostheses, surfaces and hospital environment. Species is resistant to heat treatments, UV, oxygen radicals, gastric acids, pasteurization; some antibiotics, having the ability to use sialic acid (a prebiotic additive in infantile milk powder) and exceptional affinity for biofilms in enteral feeding tubes. Isolation/enumeration requires long duration (07 days). In Algeria, the findings are absent of legal texts and national quality standards for this species. Due to food contamination, infections caused by *Enterobacter sakazakii*, strict control measures are urgently needed to reduce the risk of contamination at different levels: - Industrial, to avoid contamination of products, reducing the risk of contamination of reconstituted products during packaging of the preparation, handling and storage; - Legislative measures, by establishing guidelines, recommendations, standards, issued by the authorities to ensure food safety especially for infants.

Key words: *Enterobacter sakazakii*, Enumeration, Standards, Food quality Legislation.

ANTIBACTERIAL AND ANTIOXIDANT ACTIVITIES OF THE ESSENTIAL OIL OF *CUMINUM CYMINUM* SEEDS

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Abstract

Cuminum cyminum (in arabic: Kemoun) constitutes an important reservoir of therapeutic, cosmetic, bio-food and technological agents. Ancient civilizations used this plant for therapeutic purposes. These extracts are nowadays strongly used in the industrial and research fields, particularly, in the medicinal, pharmacological and cosmetological fields. Bioactive molecules extracted from *Cuminum cyminum* may exhibit biocidal activities and prove to be good candidates for new antioxidants. The objective of the present work is to evaluate the biological properties of this plant, including antibacterial and antioxidant effects. The seeds of cumin are harvested at the wilaya of Biskra, and stored in a dry place until their use. They were identified at Hassiba Benbouali University of Chlef. Essential oils are obtained by hydro-distillation using a Clivenger type device (AFNOR, 2000). The samples obtained are stored in sealed bottles at low temperature (4°C) and away from light. The antibacterial effect is assessed by the disc method. The minimum inhibitory concentration (MIC) is obtained by the method of Remmal et al. (1993) and Satrani et al. (2001). The antioxidant activity is evaluated by the DPPH free radical trapping method of the methanolic extracts. The essential oil of *C. cyminum* shows a better activity against Gram+ strains compared to Gram- strains. The determination of MICs leads to the conclusion that its activity can be triggered at a very low concentration. The reaction with DPPH gives an interesting IC50. This testifies to the ability of this essential oil to reduce free radicals. Thanks to the antibacterial activities that we have highlighted, cumin can be considered as a palliative that could replace certain antibiotics. Moreover, its antioxidant activity allows us to use it as a natural food additive.

Keywords: *Essential oil, antibacterial activity, antioxidant activity, Cuminum cyminum.*

INSECTICIDAL ACTIVITY *IN VITRO* OF *SACCOCALYX SATUREIODES* ESSENTIAL OIL ON BLACK BEAN APHID *APHIS FABAE*

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Abstract

As part of the development of integrated control against the agricultural pests associated with the cultivation of the broad bean *Vicia faba* L. and with the aim of reducing the use of synthetic chemicals, the insecticidal properties of the essential oil of *Saccocalyx satureioides* have been studied *in vitro* on the black aphid of the bean *Aphis fabae*. The essential oil has been extracted by hydrodistillation, the yield is 2%. Bioinsecticide tests have shown high toxicity with an $LD_{50} = 0.40\mu\text{l.mL}^{-1}$ and a recorded mortality rate of 94%. The essential oil of the *Saccocalyx satureioides* plant is very toxic to the pest *Aphis fabae* and may be used as a bioinsecticide.

Key words: *Black beans, essential oil, in vitro.*

VALORIZATION OF FIG TREE (*FICUS CARICA*) IN ALGERIA

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Abstract

The fig tree (*Ficus carica* L.) is one of the most economically and socially important fruit species representing one of the three main fruit productions of Algeria. This importance is mainly related to a multiplicity of uses and the exchange of genetic material, which led to its diversification and spread. In this case, genetic improvement is becoming an important area of research to have better crops, and a prior collection of information is needed mainly with regard to its genetic variability. For the first step of improvement, we focused on a description and identification of the local fig varieties existing in Algeria, which prospecting led us to know the varietal diversity of the fig tree (the appointment and dispersion of varieties in several regions of Algeria) so this survey was the first cultural interest in the fig tree in Algeria. The importance of *F. carica*, as an alternative to the healing of certain diseases; has been recognized throughout the centuries, and today it appears in several pharmacopoeias and books devoted to medicinal plants. As well as among natural products that are used as a rich source of bioactive compounds of high economic value, due to their use in the cosmetic, pharmaceutical, and agricultural industries. These results of the survey led us to launch a genetic study in order to characterize and slice between existing varieties. This work is considered as a starting point towards genetic improvement leading to the recovery and sustainable management of this species.

Keywords: *fig tree, local varieties, Valorization, Algeria.*

INFLUENCE OF STORAGE TEMPERATURE ON THE DEVELOPMENT OF YEASTS IN FRUIT JAM WITH POTASSIUM SORBATE

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Abstract

The aim of our work was to study the change in the quantity of yeast in unsterilized fruit jam with potassium sorbate, packaged in soft packs of the “Doy Pack” type, at different storage temperatures to establish shelf life. The objects of research were samples of blueberry jam, canned by hot bottling using potassium sorbate and packaged in soft packs of the “Doy Pack” type. The *Saccharomyces cerevisiae* and *Candida scottii* strains were used. Jam samples infected with test microorganisms were placed in a refrigerator ($6\pm 1.0^{\circ}\text{C}$) and in a thermostat ($24\pm 0.5^{\circ}\text{C}$). The control samples of jam in the original packaging were also stored at the same temperatures. Sampling of contaminated products was carried out every 3-4 days for 28 days, then every 2 weeks. Control samples of jam were examined monthly. In addition, organoleptic and physicochemical parameters of control and infected samples were determined. As a result of studies, it was found that the industrial sterility of the control samples of jam remained during 6 months of storage at temperatures of 6°C and 24°C . Organoleptic and physicochemical parameters of control samples of product during storage did not change compared to their initial value. The storage of yeast contaminated samples at different temperatures indicated the absence of favorable conditions for the development of microorganisms. At a storage temperature of 24°C , all test microorganisms died after 25 days of storage. Visible changes in the organoleptic characteristics of contaminated samples were not detected. After the 4 months of storage at a temperature of 6°C , contaminated samples contained yeast in the amount of some tens of CFU/cm^3 . The data obtained suggest that canned blueberry jam by hot bottling using potassium sorbate, packaged in a soft pack “Doy Pack” type, is resistant to microbiological spoilage and can be stored for at least 6 months under standard conditions.

Keywords: *Jam, Storage, Yeast, Survival.*

HPLC ANALYSIS AND ANTIMICROBIAL POTENTIAL OF PLANT EXTRACTS

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Abstract

The use of plant and its products has a long history that began with folk medicine and through the years has been incorporated into traditional and allopathic medicine. The therapeutic effect of these plants is related to the content of many biologically active compounds, including flavonoids, phenols and tannins. Although there were several hundred thousand plant species around the globe, only a small proportion has been investigated both phytochemically and pharmacologically. Therefore, the aim of this study was to determine polyphenolic compounds and antimicrobial potential of acetone extract of *Echium italicum* and *Anchusa officinalis*. The plants belong to the family *Boraginaceae*, and have long been used in folk medicine. Determination of polyphenolic compounds in tested extracts was performed by HPLC analysis. The antimicrobial potential of acetone extracts was examined by the microdilution method. HPLC analysis of examined extracts of *A. officinalis* and *E. italicum* confirmed the presence of the following polyphenolic compounds: p-hydroxybenzoic acid, chlorogenic acid, p-coumaric acid, ferulic acid, sinapinic acid, rutin, lutein glycoside, apigenin glycoside, rosmarinic acid, quercetin, lutein, naringenin and kaempferol. Acetone extracts of the tested plants showed extremely good antimicrobial potential compared to the standard antibiotic amracin. The maximum antimicrobial activity showed by the acetone extract of *E. italicum* in the control of *S. enteritidis* (3.91 µg/ml) and *P. vulgaris* (7.81 µg/ml), and acetone extract of *A. officinalis* in the control of *E. aerogenes* and *L. ivanovii* (31.25 µg/ml). This study showed that acetone extracts had a significant amount of polyphenolic compounds with extremely good antimicrobial potential.

Keywords: HPLC analysis, Antimicrobial potential, Plant, extract.

PHYSICOCHEMICAL PROPERTIES OF HONEY FROM THE ENTITY OF REPUBLIC OF SRPSKA (BOSNIA AND HERZEGOVINA)

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Abstract

The present study aimed to evaluate physicochemical characteristics and quality of honey from the entity of Republic of Srpska, Bosnia and Herzegovina. For this purpose, 19 samples of *Apis mellifera* honey of different floral types were obtained from different locations in entity of Republic of Srpska, collected in the period 2016-2019. Reducing sugars, saccharose content, moisture, free acidity, ash, electrical conductivity, hydroxymethylfurfural (HMF), pH and diastase activity (DN) were analyzed using recommended methods to satisfy regulatory requirements. The efficiency of the qualitative tests (Fiehe's test, Lugol's reaction, Lund's reaction) was tested. The quality of the honey types varied, based on botanical origins, and presumably, handling and storage conditions. Among the overall determined parameters diastase activity and free acidity in one honey was not acceptable according to national and international regulations. Also, all qualitative tests were negative, indicating that all samples were of natural origin, without adulteration. The regression analysis clearly indicated that acidity in acacia honeys is highly correlated with electrical conductivity, diastase activity and moisture, but negatively correlated with HMF content. Also, the positive correlation of electrical conductivity, moisture and diastase activity, and negative with HMF content was observed.

Keywords: *Honey, physicochemical properties, quality.*

TESTING OF SULFONAMIDE RESIDUES IN FOOD IN THE ENTITY OF REPUBLIC OF SRPSKA (BOSNIA AND HERZEGOVINA) IN 2019

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Abstract

Sulfonamides are broad-spectrum antimicrobials. Due to their properties that they show in the treatment of Gram positive and Gram negative bacteria, as well as certain fungi, they have been used in all intensive food production of animal origin. For these reasons, it is important to monitoring their residues in food of animal origin. Analyzes were performed with an ELISA test, with a detection limit of 5 µg/kg. In our study, 382 samples (100 muscle samples, 180 raw milk samples, 98 egg samples, 2 fish samples and 2 milk powder samples) were analyzed. The assay values recorded did not exceed the maximum levels of sulfonamide residues for the above samples.

Keywords: *sulfonamides, food of animal origin, elisa.*

CLIMATE CHANGE AS A THREAT MULTIPLIER: CASE STUDIES OF NIGERIA, SUDAN, AND SOUTH SUDAN

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Abstract

The objective of this study is to understand the linkage between Climate Change, Drought, Desertification, Agriculture, Access to Land, Food price, Food Security, Energy Available, Migration, Impoverishment, Armed Conflicts, Limited Access to Mitigation (capital, markets, infrastructure and technology) and Governance. Three Case Studies are analyzed: Lake Chad (Nigeria, Niger, Cameroon and Chad); Sudan (Darfur) and South Sudan. Climate Change acts as a threat multiplier together with ineffective responses by state security forces, a lack of traditional conflict resolution mechanisms, a lack of government legitimacy, poverty, religion, identity and endemic corruption. With the Global Warming process, limited access to Mitigation, and Fragile Governance, Sub-Saharan and Middle East countries will face severe social, economic and security problems due to the deterioration of their Food Security and increasing the risk of Armed Conflicts. It will cause thousands of deaths and massive migration with international security consequences. One project to fight malnutrition could be led by local entrepreneurs who create a chain of restaurants that deliver healthy cheap meals with food planted by small family farmers in the region. The low cost of the meals would be due to the direct production of small family farmers and therefore without the intermediary. Another project could be social enterprises that produces and sells rainwater harvesting systems to be used for irrigation purposes without damaging plants and roots. It also increases access to clean water for domestic uses of small family farmers. An additional opportunity is to employ solar energy to drain water from soil or rivers. Irrigation is frequently implemented in country areas with reduced access to consistent electrical energy or fossil fuel provisions. Solar energy is a plentiful supply in a lot of developing nations where irrigation is vital to food safety and global trade.

Keywords: *Climate Change, Food Security, Armed Conflicts, Migration, Human Trafficking, Projects to Fight Malnutrition, SSA.*

SALICYLIC ACID AS ALTERNATIVE TREATMENT FOR SULFUR DIOXIDE TO CONTROL ROT INCIDENCE AND IMPROVES THE QUALITY OF COLD STORED 'FLAME SEEDLESS' GRAPES

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Abstract

The grapes suffer from some of the problems of export and supply, the most important of which is the rot incidence, water loss, rachis browning and berry shattering. Sulfur dioxide (SO₂) is used commercially either by fumigation or releasing pads to prevent the growth of *Botrytis cinerea* rot during trading and storage, but alternative methods are needed to avoid SO₂ residues. The present study has been focused on the reduction of SO₂ application by using salicylic acid (SA) as natural and safe antimicrobials. Grapes (*Vitis vinifera* L. cv. Flame seedless) clusters were treated with one of the following treatments: distilled water (control), sulphur dioxide (SO₂), 1mM/L SA and 2mM/L SA. Afterward, the clusters were air dried, randomly packed in perforated (4% ventilation) plastic punnets (weight approximately 450 g), put in carton boxes, cooled and stored at 0°C and 95% relative humidity (RH). After 10, 20 and 30 days of storage a group of each treatment was transferred to shelf life for 2 days at 20°C and then evaluated. The results showed that SA at concentration of 2mM/L reduced rot incidence, weight loss, rachis browning and berry shattering up to 20 days at 0°C plus two days shelf life at 20°C.

Key words: grapes, decay incidence, browning, postharvest, antioxidants.

IMPACT OF ECOFRIENDLY RESISTANCE INDUCERS IN GREEN HOUSE AND FIELD TO CONTROL BARLEY DISEASE

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Abstract

The antifungal activity of resistance inducers; Mono potassium phosphate (KH_2PO_4), chitosan clay Nano composite (ccnc), humic acid (HA), Si was tested in controlling *Pyrenophorateres* Ana morph: Drechslera teres the causal organism of net blotch of barley. The evaluation was carried out at barley adult plant stages using two rowed hulled Giza 128 and six rowed hulled Giza, 130 under green house and open field conditions at two locations; Giza and Sakha stations GIZA and Kafr el Sheik Governorates, Egypt in 2020 growing season. All concentrations of the four tested inducers were significantly and negatively correlated with each of the biochemical traits. The highest correlation was observed between DS and 1,3- glucanase after 15 days. Spraying barley plants of the two studied cultivars with the tested inducers showed significant correlation between disease severity and thousand kernel weight (TKW), plot weight, total protein, total lipids, total fiber, crude ash and total carbohydrates. It is worth mentioning that decreased disease severity resulted in a significant increase of 1000 kernel weight (g) compared to the control. Stubble-borne diseases, spot form of net blotch (SFNB), net form of net blotch (NFNB) will be present in many paddocks due to carry-over from the last two seasons. Soil-borne diseases are a risk to barley and testing prior to sowing allows at risk paddocks to be identified and avoided. On the other hand using four inducers decreased disease severity and safety they have no toxic residues and are environmentally friendly and cost effective compared with ordinary fungicides. An explanation of the resistance ratings used was provided in this guide for foliar diseases, and how they should be interpreted (R) Resistant, (MR) Moderately Resistant, (S) Susceptible, (VS) Very Susceptible.

Keywords: Barley, Antifungal activity, Biological control, Inducers, Egypt.

COMPARING ESSENTIAL OIL QUALITY OF FINE LAVANDER AND LAVANDIN, IN THE FRENCH PERFUME INDUSTRY

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Abstract

MailletteLavander, AOC Lavander and Lavandin essentials oils are mostly used in the perfume industry. We can notice Lavandin and MailletteLavander are competing in the cosmetology sector. To observe this phenomenon, we did a study on the Lavander and Lavandula quality control. Their chemical component must be checked within a quality control process, along with sensorial analysis data to consider the consumer opinion. Quality criteria intended for the French perfumery are not the same according to the chromatographic analysis or the sensorial analysis. That is why it was needed to check the potential perceptions variations data between chromatographic analysis and sensorial analysis. Panellist profile has not much influence on both his choice at the preferential test and on his success at the differential test: sensorial analysis results stay subjective. The chromatographic analysis identifies the AOC Lavander and the MailletteLavander as high-quality essential oils. Indeed, these Lavander oils have many strong smells, chemical component, such as “Lavander” and “lemony” smells (linalool and linalyl acetate). The sensorial analysis results vary: even if the panellists distinguished different perfumes, they would prefer the MailletteLavander. Quality criteria observed by both analyses are not quite the same. Moreover, we can assure the Maillette essential oil has a better olfactive quality more suitable for the French Luxury Perfume Industry, unlike the Lavandin essential oil.

Keywords: *essential oil, lavender and lavandin, chromatography and sensorial analysis.*

IDENTIFICATION OF HIGH YIELDING WHEAT GENOTYPES UNDER DIFFERENT ENVIRONMENTAL CONDITIONS OF GEORGIA

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Abstract

Eight entries (Attila*2/P8-20HRWYT-5, Tacupeto-F2001/6/CNDO-20HRWYT-225, Kinaci-97, Amsel/TUI//, CUPRA-1/3/CROC1/AE.SQUARROSA(224)//2*OPATA/4 /PANTHEON, KR-11 -9043, KR11-003, KR11-014) with resistant reaction type and low disease severity to rusts selected from different Facultative- and Winter Wheat Nurseries obtained from CIMMYT and ICARDA were tested at field conditions in three sites of Georgia: Meskheti, Javakheti and Shida Kartli. The main agronomic characteristics, like spike length, number of grains in spike, 1000 –kernel weight and average yield of selected genotypes were determined according to the international standards. According to these characteristics all of tested genotypes were superior to the check variety - Bezostaya-1. The data analyses of ecological testing results were done using a two-way ANOVA to estimate the effect of two factors – geographic zone and genotype on the yield and yield components. ANOVA for main characteristics showed that the effects of genotypes were statistically significant at all locations. The effects of geographical zones were not statistically significant. As results the trials' data analysis the genotype - CUPRA-1/3/CROC1/AE.SQUARROSA (224)//2*OPATA/ 4 /PANTHEON selected from 17FAWWON-SA nursery as improved wheat variety has been submitted for release as a new variety “Lomtagora 143” in Georgia. It is bread wheat variation (var. *lutescens* (Alef.) with 10.5 cm length spikes, 20 good-developed spikelets and 65-70 red, hard grains in each spike; It is characterized by great emergence, strong root system, good tillering and moderate resistant to rusts. 1000- kernel weight is 45 gr, the average yield - 6.5 t/ha. Lomtagora 143 is recommended to produce in Kartli, Meskheti and Javakheti zones.

Keywords: *Wheat variety, Rust resistance, Yield, Georgia.*

SPECIES COMPOSITION OF *ALTERNARIA* DISEASES OF POTATOES IN GEORGIA

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Abstract

In recent years, in many countries of the world, including Georgia, *Alternaria* diseases caused by the fungus of the *Alternaria* genus are widespread on potatoes belonging to the Solanaceae family. They are polyphages that develop on a wide range of plants, causing pathological processes in living organisms, which ultimately leads to a reduction in commercial value, quantity, and quality of crop yield. The aim of our study was to detect *Alternaria* diseases on potatoes and to study the species composition of the pathogen in various regions of the potato production area in Georgia. For this purpose, 420 isolates of *Alternaria* genus with different morphological characteristics were cultured on PDA from the samples collected in the areas of Akhaltsikhe, Akhalkalaki, Svaneti, and Upper Adjara during the growing season and the period of storage of potatoes in 2016-2019. To determine the species composition of the fungus, in addition to the classical mycological methods, a specific PCR method of molecular biology was used with the addition of the following pairs of different specific primers: AAT-F/AAT-R, AlonR/Alon-F, Aarb-F2/AltAtp-R, ADR1/ADF2, ABCrev/ABCsen. The DNA of the microorganism was isolated using the Kit (GF-1 DNA extraction kit). Based on morphological and molecular characteristics, we identified three *Alternaria* species whose spread percentage varied: *Alternaria Alternata* 36-39%; *Alternaria Tenuissima* 28-32% and *Alternaria Solani* 32-34%. The results of the study showed that three species of the causative agent of *Alternaria* diseases, such as *A. alternata*, *A. tenuissima* and *A. solani* are mainly spread on potatoes in the above-mentioned regions in Georgia.

Keywords: *Potato, Disease, Fungi, PCR, Alternaria.*

INVESTIGATING SELENIUM MEDIATED BIOCHEMICAL MECHANISMS FOR IMPROVING FOOD QUALITY IN WHEAT UNDER WATER LIMITED ENVIRONMENT

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Abstract

Increasing temperatures and insufficient precipitation predict significant yield losses in food crops in the future. The risk of increased environmental variations leading to recurrent droughts suggests the development of new management strategies to reduce this threat to global food security. Selenium (Se) is an important mineral nutrient that can stimulate plant growth and confers tolerance against environmental extremes including drought. In this study, we investigated the effects of Se supplementation on drought stress mitigation in wheat. Specifically, the emphasis was placed on understanding how mineral content of wheat grain is influenced by exogenous Se supply under normal and water deficit conditions. Our results showed that Se application (either via foliar spray or fertigation) considerably enhanced drought tolerance in wheat through maintenance of tissue water content, increased activity of photosynthetic apparatus and accumulation of osmolytes. High activity of antioxidative enzymes was found responsible for reduced oxidative damage in Se treated plants compared to no Se application. A pronounced effect of Se supplementation was also recorded on nutrients concentration. It was observed that Se application not only increased Se content, but also facilitated the accumulation of zinc, iron, magnesium and calcium in wheat grains. We found that Se foliar spray was more effective than fertigation to increase nutrients concentration in wheat under water deficit conditions. The study highlights the importance of Se in improving grain nutrient content in wheat.

Key words: *Selenium, Zinc, Photosynthetic apparatus, Antioxidant machinery, Wheat.*

EFFECTS OF DIFFERENT TREATMENTS ON RUNOFF AND SOIL LOSS IN CENTRAL GREECE

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Abstract

Soil erosion is one of the biggest problems in agricultural sector that can affect the ecosystems and the human societies. In this study, a field experiment was conducted in Central Greece (Larisa). A field of slope 10⁰ was selected to study the runoff and the soil loss in different treatments (tillage and no-tillage cultivation, plant cover and no plant cover, cultivation by contour and by slope) under natural rainfall. The experiment was conducted in two periods. In autumn the field was cultivated with mixed *Triticosecale* spp. and *Pisum sativum* and in spring with *Helianthus annuus*. The total rainfall was 141.4 mm, 88.4 mm in spring period and 53 mm in autumn period. According to the results, in autumn period the soil loss was bigger in comparison with spring period. In the case of runoff, it was bigger in most of the treatments in spring period in comparison with the autumn session. The plots in which were conducted no-tillage cultivation by contour with plant cover were more effective in runoff and in soil loss.

Keywords: *Runoff, Soil Loss, Natural Rainfall, Greece.*

ALLELOPATHIC EFFECT OF WALNUT AND BLACK WALNUT ON GERMINATION AND SEEDLING DEVELOPMENT OF PROSO MILLET, VELVETLEAF AND JIMSON-WEED

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Abstract

Walnuts are a highly sought-after fruit species in Europe. Almost all European countries have a long tradition of using walnuts. In Hungary, the ecological conditions that are necessary for growing walnuts are available. Current agricultural practice encourages researchers to develop alternative weed control strategies. Herbicide dependence is a significant problem worldwide because there are few other methods available for weed control so far. Research should seek to apply existing and develop new basic knowledge. The aim of our experiment was to investigate the allelopathic effects of common walnut (*Juglans regia*) and black walnut (*Juglans nigra*) on proso millet (*Panicum miliaceum*), velvetleaf (*Abutilon theophrasti*) and jimson-weed (*Datura stramonium*) under laboratory conditions. Taken together, common walnut and black walnut were also found to have stimulatory and inhibitory effects on the plants studied. The stimulating effect was stronger in the case of black walnuts, and two effects were more or less the same in the case of ordinary walnuts. It was not possible to state in all experiments that the effect was a function of the concentration, some of the experiments confirmed this, others refuted it. In the future, further experiments and studies are needed to study the allelopathy of common walnut and black walnut. An important goal could be the accurate identification and quantification of allelochemicals in them. Common walnuts have a stronger effect on the growth of three weed species than black walnuts. It is likely that millet is also able to utilize the extracts as a nutrient, and this also contributes to the stimulant effect. We found that the inhibitory and stimulatory effect was concentration-dependent, and in general, higher-concentration extracts had a stronger effect.

Keywords: *Walnuts, allelopathy, proso millet.*

TOXICITY TEST OF INDIVIDUAL AND COMBINED TOXIC EFFECTS OF GLYPHOSATE HERBICIDE AND HEAVY METALS ON CHICKEN EMBRYOS

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Abstract

The aim of this study was to determine the individual and combined toxicity of Glialka Star herbicide (glyphosate 360 g/l) and heavy metals (copper and cadmium) on the development of chicken embryos. On the first day of incubation, chicken eggs were injected by 0.1 ml of the test materials. The applied concentration of copper and cadmium sulphate was 0.01% and that of herbicide Glialka Star was 2%. The chicken embryos were examined on day 19 by the followings: rate of embryo mortality, body mass, type of developmental anomalies by macroscopic examination. The body weight was evaluated statistically by one-way ANOVA combined with Dunnett post-test, the embryo mortality and the developmental anomalies were analysed by Fisher test. Our teratogenicity study revealed that the combined administration of heavy metals (copper, cadmium) and glyphosate (K-salt) containing herbicide formulation caused significant reduction in the body weight of embryos and a significant increase in the rate of embryonic mortality and the incidence of developmental anomalies. The joint toxic effect of heavy metals and Glialka Star is an additive effect compared to the individual toxicity of the test materials.

Keywords: *glyphosate, heavy metals, interaction, embryotoxicity, chicken embryo.*

INTRODUCING THE TOP SPECIES OF IRANIAN ROSES IN TERMS OF FLOWER PERFORMANCE IN ISLAMABAD-E-GHARB RESEARCH STATION LOCATED IN KERMANSHAH PROVINCE IN IRAN

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Abstract

Golmohammadi flower, scientifically named *Rosa damascene* Mill from the Rosacea family, has played an important role in the perfume and rose making industries and it is very popular. This study was performed in Islamabad-e-Gharb research station located in Kermanshah province in Iran. Comparison of flower yield in 15 genotypes of Golmohammadi collected and planted from different parts of the country with the coordination of Forest and Rangeland Research Institute was done. The research was conducted in the form of a complete randomized block design with 3 replications for 5 years (2012-2015). Important morphometric specifications, including petal weight, were evaluated. The results of this study showed that the average dry weight of petals in Fars 1, West Azarbaijan 1, Lorestan 1 and Kermanshah 9 genotypes was higher and in Isfahan 5, Isfahan 7 and Kermanshah 10 genotypes where it was the lowest. In general, the role of this function and the genotypes studied can be effective in improving the lives of local residents in mountainous and cold areas.

Keywords: *Islamabad-e-Gharb, Genotype, Golbarg, Golmohammadi flower.*

HYBRID SIEVE-HEATER AND INFRARED DRYING OF SAFFRON STIGMA: EFFECTS OF TEMPERATURE, AIR VELOCITY AND INFRARED RADIATION ON KINETICS AND QUALITY PARAMETERS

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Abstract

Saffron is a dry, Red color stigma and stylets of the *Crocus sativus L.* which is the most expensive spice in the world. Drying is an important step in the process of saffron production. It causes physical, chemical and biochemical changes to achieve the desired properties of saffron. In this study, the kinetics of drying saffron stigma using a novel method with Hybrid Sieve-Heater and infrared dryer at two temperature levels of 40, 45 °C, two hot air flow speeds of 0.3 and 0.6 m/s and two levels of 125 W and 250 W radiation were studied. An image-based method for measuring tortuosity of saffron stigma was also proposed. The tortuosity of saffron could be an indicator for its shrinkage. The effects of the studied parameters on the amount of Crocin, Picocrocin and Safranal and of the final product were also investigated. The results showed that, the two term model was found to be the best model in fitting data of both drying methods. Increased lamp power, temperature and air velocity caused reduction in the drying time of saffron. The lowest amount of tortuosity variation was related to the traditional drying method in the shade and treatment at 40 ° C, hot air speed 0.3 m/s, and infrared radiation of 125 watts. In terms of maintaining the color strength of saffron, the highest Crocin was obtained when the Hybrid Sieve-Heater and infrared dryer was adjusted at 40 ° C, hot air speed 0.6 m/s, and infrared radiation of 125 watts which was the highest among all other treatments.

Keywords: *Saffron, Hybrid drying, air velocity, kinetics, quality.*

BIOPOLYMER PRODUCTION FROM ISOLATED LACTIC ACID BACTERIA FROM IRANIAN KISHK

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Abstract

Exopolysaccharides are high molecular weight polymers composed of sugar subunits. Produced exopolysaccharides by lactic acid bacteria play a significant role in improvement the sensory and texture 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 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 like 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. The results showed the pH of Kishk samples ranged from 3.6 to 4.08 and the average of total mesophilic count and Lactic acid bacterial count of samples were 6.5 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 maximum and minimum production by weight method were 5.34 g/L and 0.002 g/L, respectively. The highest and the lowest amount of exopolysaccharide by phenol sulfuric method were measured 3.81 g/L and 0.0015 g/L, respectively. This study indicates the potential of exopolysaccharide production by Iranian native species from dairy products.

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

ECOLOGICAL INPUTS IMPROVED SESAME WATER USE EFFICIENCY IN AN ARID REGION

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Abstract

Field experiments were conducted using randomized complete block design with split-strip plot arrangement and three replications in two successive cropping years (2016–2017) to evaluate the effects of SA, SAP and two levels of irrigation on *Sesamum indicum* L. Irrigation levels consisting of supplying 50% and 100% of the sesame water requirement (WR) were allocated to the main plots, application of SAP (80 kg ha⁻¹) into the soil and control (no application of SAP) were allocated to the subplots. Foliar application of SA (1 mM) and control (no application of SA) were allocated to the strip plots. The results showed that the highest seed yield was obtained from supplying 50% water requirement, SAP and SA application. Under drought stress (50% WR), separate and simultaneous application of SAP and SA, increased water use efficiency by 42% (SAP), 36% (SA) and 43% (SAP+SA), respectively, compared with control. The highest WUE was achieved from treatment of 50% WR plus SAP application, which was 60% more than combination treatment of 100% WR plus non-application of SAP. The results of principle component analysis indicated that seed yield, seed weight per plant, crop growth rate (CGR) and WUE were the effective variables of the first principle component and explained 67% of the total variance in the data. Considering all variables contributing in yield formation of sesame along with WUE, the strong existence of positive correlation between them suggests that any relative improvement in the mentioned variables particularly CGR will result in a direct increase in WUE.

Keyword: *Foliar application, Growth analysis, Principle Component Analysis, Water Requirement.*

EVALUATION OF ORNAMENTAL ANTHURIUM CULTIVARS REACTION TO CUCUMBER MOSAIC VIRUS-CMV IN GREEN HOUSE CONDITION

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Abstract

Ornamental Anthurium is one the main cut flower in domestic market in Iran. Approximately, 5000 hectares (land and screen-houses) are under ornamental cultivation in Iran and viral diseases incidences are one of the main factor limiting Anthurium production. This brings the importance of screening Anthurium for resistance to important viruses, with a goal to select the better-quality flower for domestic and export markets. *Cucumber mosaic virus*-CMV is one of the most important virus diseases infecting Anthurium in Iran. In this study the reaction of 14 commercial Anthurium cultivars were evaluated against an isolate of *cucumber mosaic virus*-CMV under the greenhouses condition. Pot samples of 14 commercial cultivars: Carnaval, Color, Rosa, Angel, Pistach, Presense, Simba, Calisto, White, Zavia, Fantasia, Midori, Fire and Milion of *Anthorium* were transferred to green house. According to the methods described, the cultivars were mechanically inoculated for CMV sensitivity and kept in greenhouse with ambient conditions, controlled temperature and humidity. Cultivars evaluated based on severity of symptom appearance and serological reading following the methods described. The cultivars were then divided into 12 groups in terms of morphological symptoms. The results of this study showed the lowest infection rate in two cultivars White and Fantasia and the highest infection rates in Color cultivar. All of inoculated samples were tested serologically by DAS-ELISA. The results of the ELISA test showed all the white, red and pink cultivars were infected by CMV. The cultivars in red (Color, Million, Fire) were the most susceptible and the cultivars in white (White, Fantasia) were less susceptible to CMV. Thus, two Anthurium cultivars White and Fatasia is reported to be a superior cultivars against infection by CMV.

Keywords: *Anthorium*, *CMV*, *cultivars*, *resistance evaluation*.

STATUS OF TWO DAMAGING ORTHOTOSPOVIRUS TSWV AND INSV ON LETTUCE PRODUCTION IN IRAN

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Abstract

Lettuce (*Lactuca sativa* L.), which is a seasoned vegetable, is a one-year-old plant and is cultivated both in the field and greenhouse in Iran. The total cultivated area is 17,000 hectares and production is 570,000 tons in Iran. Since the green leaf lettuce has an oral intake, viral infection and damages to the leafy parts cause severe drop in the quality and marketability of lettuce. So far, several viruses infecting lettuce has been reported worldwide, referring to the importance of *Tomato spotted wilt virus*-TSWV and *Impatiens necrotic spot*-INSV. In order to determine the distribution and extent of lettuce contamination with these two important *orthospovirus*, a total of 222 suspicious samples randomly selected and with virus infection were collected from three main lettuce production zone in Alborz, Mazandaran, and Tehran provinces. Samples were tested by specific antibodies (Bioreba-France) using DAS-ELISA against infection with TSWV and INSV. Positive samples were inoculated to suitable indicator plants: *Datura metel*, *Chenopodium amaranticolor*, *Vigna anguiculata*, *Capsicum annum* and the symptoms were recorded. The results showed that 102 samples (45.9%) were infected to TSWV including 97 samples from Alborz and 5 samples from Mazandaran. None of the samples showed infection with INSV. In total, the viral damage and symptoms reports by farmers in Alborz were much higher than in Mazandaran provinces. Positive samples in DAS-ELISA were tested in RT-PCR with specific primers described for TSWV. The PCR product was consistent with the TSWV genome and an amplification band of 777 bp. was observed in gel-electrophoresis.

Key word: lettuce- *orthospovirus*, TSWV, INSV, serology.

REPORT OF IMPORTANT VIRUSES INFECTING ORNAMENTAL ANTHURIUM IN TEHRAN PROVINCE OF IRAN

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Abstract

During the period 2014-2015 a total of 504 symptomatic ornamental Anthurium leaf samples with virus like symptoms including leaf and flower blister, dwarfing, mosaic, yellowing, leaf marginal chlorosis and deformity or lack of flowers were collected from Varamin and Pakdasht (Tehran province) greenhouses. Samples were tested for *Cucumber mosaic virus*-CMV, *Tomato spotted wilt virus*-TSWV, *Impatiens necrotic spot virus*-INSV and *Dasheen mosaic virus*-DaMV infection by DAS-ELISA using specific antibodies. The positive samples were mechanical inoculated by 0.01M phosphate buffer pH=7.2 contain 0.15%, 2-Mercaptoethanol on suitable indicator plants and were established in greenhouse. Results indicated that the most prevalence viruses were CMV (31.54%) following by TSWV (25%) and DaMV (7.93%). No INSV positive samples were detected in this study. Results of mechanical inoculation on host range reaction using isolates of CMV, TSWV and DaMV were consistent with the previously reported descriptions for these viruses. However, total RNA in samples with positive reaction to CMV and potyviruses (to detect DaMV) in ELISA were purified and RT-PCR method was carried out gene amplification of CMV and DaMV. Coat protein gene sequence of Iranian CMV isolate showed highest similarity (97%) with a CMV isolate *Cucurbit pepo* (Acc. No. GU327368.1) from South Korea. Furthermore, DaMV was also detected from the selected samples by molecular test which led to proper amplification of this virus. This is also the first report of DaMV incidence in Iran.

Key words: *Cucumber mosaic virus*, *Tomato spotted wilt virus*, *Dasheen mosaic virus*, ELISA.

EFFECT OF CERIUM OXIDE NANO-PARTICLES ON MICROBIAL COMPOSITION AND PHENOL REMOVAL BY IMMOBILIZED BIOMASS

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Abstract

The increasing use of metal and metal oxide nanoparticles (Me/MeO NPs) in various products along with the increase in their concentrations in wastewater effluent have raised concerns about their fate. This increase in the entry of NPs could have unforeseen effects on the wastewater treatment process. Cerium oxide NPs (CeO₂ NPs) are one of the most widely used and at the same time hazardous NPs. As the biological treatment process is carried out by the microbial population, the effect of CeO₂ NPs presence was investigated on the microbial composition immobilized on the packing materials in a lab-scale trickling bioreactor (TBR) within an exposure to a synthetic wastewater containing phenol as the COD. The sludge which was used as a microbial community with an initial concentration of 4000 mg MLSS/l under immobilized condition was able to completely degrade phenol with the initial concentration of 700 mg/l over 3 h. The performance of TBR for phenol biodegradation decreased in the presence of 50 mg/l CeO₂ NPs in the wastewater, when phenol was degraded 80% after 3 h. Total DNA was extracted from microbial samples before and after exposure experiments for NGS sequencing with Illumina. Sequenced reads showed that the microbial community was able to adapt to the presence of 50 mg/l CeO₂ NPs after long-term contact by minor changes in *Actinobacteria*, *Proteobacteria* and *Deinococcus-Thermus* in the phylum level.

Keywords: *Cerium oxide, NGS sequencing, Phenol, Trickling bioreactor, Wastewater treatment.*

BE SMART TO SURVIVE: VIRUS-HOST RELATIONSHIPS IN NATURE

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Abstract

In order to survive in nature, different pathogens follow different procedures to manipulate their host plants for the pathogen favor. Plant viruses are not an exception of this rule. They are often found to alter the host plant traits in the way that affects the community of organisms in the host plant as well as the vectoring insects. It has been indicated that virus-infected plants are more preferable than virus-free plants with respect to the growth rates, longevity and reproduction of the vector. Viruses use several strategies in order to reprogram their host's cell to make it more conducive to replication and spread. Consequently, phytohormone signaling pathway in virus-infected plants can be disrupted either directly or indirectly. In plants, there are hormone pathways contributing to all aspects of plant physiology. Sometimes, virus infection can be advantageous to the infected host by providing the plant with tolerance to biotic and abiotic stresses. This article summarizes some aspects of viruses found to reprogram the host's cell to make it more conducive to virus' cycle of life.

Keywords: *Virus-vector relationship, Plant viruses, virus manipulation of host, virus reproduction.*

MAPPING OF HERBICIDE RESISTANT *ECHINOCHLOA* SPP. POPULATIONS IN NORTHERN ITALY (LOMBARDY REGION)

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Abstract

This study is a part of the underway three-year (2019/2022) research project *EpiResistenze - Herbicide resistance and epigenetic mechanisms: innovative approach to an emerging phytosanitary problem*, funded by Lombardy Region, Directorate General for Agriculture. Italy is the first European rice producer nation, with about 230,000 ha dedicated to this cropping mainly located in northern regions. In Lombardy, the cultivation of rice is mostly carried out in aquatic environment and through single-crop cultivation. These agricultural practices and the repeated and constant use of a narrow range of herbicides favor the evolution of herbicide-resistant (He-R) weed populations that represent one of the most critical aspects in weed management. *Echinochloa* spp. are among the most difficult to control paddy weeds because of the development of resistance to a wide range of herbicide classes. One of the aims of *EpiResistenze* project is to map the evolution of *Echinochloa* spp. HeR in the Lombardy rice territory, analyzing HeR gene expression and focusing on the ecological (biotic and abiotic) factors related with HeR development. The mapping of HeR populations was performed during the 2019 summer season. The resistant *Echinochloa* populations were georeferenced using Q-GIS3 software, and relative maps were produced. Preliminary results show that *Echinochloa* spp. HeR populations are widely spread throughout the rice-growing area of the provinces of Pavia, Milan, Lodi and Mantua, including areas where no resistance has been detected until now. The *Echinochloa* spp. has developed resistance especially against ALS, ACCase and photosynthesis inhibitors, also showing cases of “multiple resistance”.

Keywords: *EpiResistenze*, *Echinochloa*, *Herbicide Resistance Mapping*.

POTENTIAL OF USE OF ENTOMOPATOGENIC NEMATODES TO CONTROL SOME SOFT SCALE INSECT SPECIES (HEMIPTERA: COCCIDAE)

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Abstract

Soft scale insects are all herbivorous, often polyphagous, feeding on various fruit tree species and ornamental plants. In conventional orchards they are usually controlled collaterally through management of other insect pests. However, in organic orchards, where there is no use of chemical insecticides, they are emerging as serious physiological pests. Due to ecotoxicological benefits, entomopathogenic nematodes (EPN) can be used in organic production as well as in the urban areas to control these pests. EPN were successfully used against many soil born insect pests, but also to control some of the above-ground pests. There are few recent reports of pathogenicity of EPN species on some species of Pseudococcidae and Stictococcidae, but data on susceptibility of Coccidae to EPN are lacking. The aim of this work was to investigate susceptibility of young females of *Pulvinaria hidrangeae*, *Partenolecanium corni* and *Coccus pseudomagnoliarum* to commercial strains of entomopathogenic nematode species *Steinernema carpocapsae* and *S. feltiae* and local and commercial populations of *Heterorhabditis bacteriophora*. The laboratory tests were carried out in 3.5 mm plastic Petri dishes with infective juveniles applied on filter paper. Treatments with different nematode concentrations and control were replicated five times with 10 insects per repeat. After 7 days all insects were dissected to confirm infection by EPN. Results showed that all scale insects were hosts for all tested nematode species, since the second generation of infective juveniles was observed in each case. Highest EPN infectivity was observed within highest concentration (50 infective juveniles per insect) and was above 60% in all EPN/insect species combinations. Our results showed that entomopathogenic nematodes caused high mortality rate of examined soft scale insect species and potential to be included in management strategies of soft scales control. Further work is needed for developing strategies for field application.

Keywords: *Biological control, Steinernema carpocapsae, Heterorhabditis bacteriophora, Steinernema feltiae, native and commercial strains.*

METAGENOMIC STUDIES FOR DETECTION OF HONEYBEES VIRUSES

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Abstract

Honeybees (*Apis mellifera*) provide pollination services that are crucial for food crops and agriculture. However, declines in insect pollinators, including honeybees, have raised concerns worldwide. Diseases and parasites are among the major factors affecting pollinator health. In particular, the devastating invasive parasitic mite (*Varroa destructor*) has the greatest impact globally; this parasitic mite has also an indirect negative impact by spreading viral diseases either through the saliva or through weakening bees' immune system, thus leading to the reactivation of latent viral infections. Unraveling the health status of honeybees and the diversity of viral diseases is extremely important for managing diseases and improving the health of the colonies. In this respect, Next-Generation Sequencing (NGS) technologies are useful tools for metagenomic studies and to characterize the virome associated to honeybees. In the present work, we used the High-Throughput Sequencing (HTS) approach to examine the RNA virome from different pooled samples from diseased honey bees collected in Italy. Total RNA was purified using TRIzol reagent and used to construct Illumina TruSeq RNA libraries, which were then sequenced by 2 × 100 bp paired-end reads, generating more than 30 million reads for each library. Bioinformatic analyses showed the occurrence of several viruses belonging to different genera, such as *Ifla virus*, *Triato virus*, *Sinai virus*, *Partiti virus*, *Adenovirus*, *phycodna virus*, *Ilar virus*, *Capillo virus*, and others unclassified. The number of detected viruses in our samples was remarkable, suggesting that viruses could be one of the major threats to the Italian apiculture. Furthermore, the application of HTS technology proved to be a very successful and rapid tool for discovering viruses in honeybees.

Keywords: *Honey bees, Next-Generation Sequencing, High-Throughput Sequencing, Virus, Apis mellifera.*

DYNAMICS OF SUSTAINABILITY TRANSITIONS IN THE EGYPTIAN AGRI-FOOD SYSTEM: CASE OF ORGANIC AGRICULTURE

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Abstract

The agri-food sector plays a significant socio-economic role in Egypt. Indeed, it represents the main source of income for about 40% of the population. The deterioration of the socio-economic and environmental indicators is increasing the pressure on the Egyptian agri-food system to move towards sustainability. In this context, the present review paper tackles the dynamics of transition towards sustainability in the Egyptian agri-food system using organic agriculture as a case study. The analysis was carried out through the lens of the Multi-Level Perspective on sociotechnical transitions (MLP), a major theoretical framework in transition studies, that assumes that transition comes across the interactions within and between three levels; i) the *niche*, referring to a radical innovation or a new technology, ii) the *regime*, representing the dominant system and deep sociotechnical structure, and iii) the *landscape* shown in the external factors and trends that might affect the sociotechnical system. The results show that organic farming is a growing niche in Egypt, which accounts nowadays for 2.82% of the total agriculture land, in addition of being a perfect example for targeting a sustainable agri-food system. Furthermore, the majority of the regime actors are smallholders (<1 ha) who represent 80% of Egyptian farms, with intensive mixed crop-livestock farming. The landscape factors (e.g. climate change, capitalism, population growth, revolutions, and social unrest) are expected to put pressure on the agri-food regime and to encourage the further development of organic agriculture niche, which would, in turn, increase competitive pressure on intensive agriculture. However, concerns for long-term food security, combined with limited arable land (less than 0.03 ha per capita), might help perpetuating the regime and strengthening its lock-in. Finally, this ongoing, long-term transition might follow diverse pathways to transform and reconfigure visions, policies, cultural meanings and infrastructure relating to agriculture and food in Egypt.

Keywords: *sustainability transitions, Multi-Level Perspective, agri-food system, organic farming, Egypt.*

MECHANICAL QUANTIFICATION OF HEAVY METAL CONTAMINANTS IN HAMMER-MILLED FLOUR AND MILL DESIGN FOR ENHANCED FOOD SAFETY

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Abstract

In an attempt to enhance food safety, heavy-metal contaminants were mechanically quantified in hammer-milled flour compared to hand pounding (Hp). Hp samples, control treatment, was produced by pestle and mortar and compared to LB7-machine type, main treatments-foundry hammer mill (FHm) and artisanal hammer mill (ArtHm). The machine types were also compared. All machine types were experimented in Malawi whereas Mozambique tested FHm only. ZM523 Maize, (*Zea mais*) Hp flour sample was used whereas main treatment flour samples were from experimental hammer mills. Then, samples were analyzed by Atomic Absorption Spectrophotometry (AAS) in ppm and compared to recommended limits. Eight metal elements as Aluminum (Al), Zinc (Zn), Arsenic (As), Cadmium (Cd), Copper (Cu), Lead (Pb), Manganese (Mn) and Iron (Fe) were measured. Weight loss of beaters of machine types was also determined and then samples magnetically metal-scanned. The results, machine types achieved higher metal contents than Hp with whole maize grain flour sample ranging from 28.60±0.80 to 85.24±1.21, 35.60±0.60 to 562.05±4.11 and 0.07±0.1 to 19.18±4.0 ppm for FHm, ArtHm and Hp, respectively. Mozambique achieved similar results comparing 38.50±0.60 to 802.0±1.44 ppm to Hp. For machine type, in Malawi, ArtHm achieved much higher concentration than FHm. Much higher wearing rates of beaters of 75.02 ppm for ArtHm than 60.48 ppm FHm were recorded. For metal-contamination, all machine types achieved higher than the control. In conclusion, more metal-contaminants than recommended limits by the current hammer-mill designs, is confirmed and thus urgent need to reduce them by hammer mill redesign to enhance food safety.

Keywords: *hammer-milled flour, metal contaminants, enhanced food safety, hand pounding, health hazard.*

THE EFFECTIVENESS OF ISSR AND SSR MARKERS IN ANALYSIS OF SUNFLOWER BROOMRAPE DIVERSITY

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Abstract

Among molecular markers, Inter Simple Sequence Repeats (ISSR) and Simple Sequence Repeats (SSR) have been successfully used in population genetic studies. In present research 13 ISSR and 12 SSR markers were employed in order to determine the genetic diversity and relationships among 39 broomrape populations, collected from different regions of Republic of Moldova (Northern – N, Central – C and Southern – S) and belonging to different races (E, F, G and H). The level of genetic polymorphism, obtained with two types of markers where convergent, demonstrating that the combination of methods are important for establishment of genetic variation among *O. cumana* populations and races differentiation. Thus, the comparative analysis of PIC index revealed the values ranging from 0.27 to 0.77 with a mean value 0.57 and 0.23 to 0.48 with mean value 0.40, for SSR and ISSR markers, respectively. The Mantel test showed higher values of correlation coefficients between the races E and G (0.731), G and H (0.622), E and H (0.575) in case of SSR analysis and, respectively, 0.702; 0.670; 0.669 in case of ISSR analysis. The multiple correlation coefficients (Pearson) for broomrape populations with distinct geographic origin were quasi similar for both markers: (N:C) = 0.395 (SSR) and 0.409 (ISSR); (N:S) = 0.427 (SSR) and 0.396 (ISSR); (C:S) = 0.673 (SSR) and 0.631 (ISSR). The data obtained as a result of analysis using SSR and ISSR markers demonstrate a higher degree of genetic similarity of *O. cumana* populations from the Central and Southern regions of the country and of the race E of broomrape with G and H.

Keywords: *broomrape, sunflower, Inter Simple Sequence Repeat, Simple Sequence Repeats markers.*

DEVELOPMENT OF AN INTEGRATED MODEL TO ASSESS THE IMPACT OF PRACTICES AND LAND USE ON AGRICULTURAL PRODUCTION IN MOROCCO UNDER CLIMATE STRESS, OVER THE NEXT TWENTY YEARS

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Abstract

Climate change is expected to have a significant impact on agricultural production at local and global scale. Higher temperatures and changes in precipitation patterns projected by the Intergovernmental Panel on Climate Change (IPCC) could cause agricultural production to fall in many areas requiring significant changes in farming practices and distribution of agricultural land. A concomitant factor to climate change will be the increase of the population and its distribution and its level of consumption that also influence the strategies of agricultural production, conversion of agricultural land, the type of irrigation and technology development. Determining the consequences of these forcings on land use will depend on our understanding of past changes and market forces on the agricultural sector and how future climate change, technology, the type of irrigation, abundance, government policy vis-à-vis agriculture, the size and distribution of the population will affect agricultural production and its relation to the expansion of agricultural land. It is proposed to develop an innovative methodology that will integrate ground observations, remote sensing, socio-economic and demographic statistics and technology indicators to project the trends and patterns of agricultural land use caused by climate change and human development, i.e a model that links environmental and socio-economic factors to project their impact on the current use of agricultural land and the potential change of this use over the next 20 years.

Key words: Climate change, Morocco, agriculture production.

DIVERSITY OF BREADS MADE WITH TRADITIONAL SOURDOUGH IN A BERBER POPULATION OF MOROCCO

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Abstract

The sourdough bread consumed daily in a Berber group of the Moroccan Eastern side, FIGUIGE BOUARFA, is the result of the daily and exclusive work of women, each for their own family group. It takes about three hours to build because it runs from end to end every day. The Sourdough has been used since ancient times for its property and ability to improve the quality to increase the shelf-life of bread. The traditional sourdoughs are more varied and less concentrated than bakery yeast; they raise the dough more slowly. Also, lactic acid bacteria (LB) require many hours for fermentation to work their wonders for producing a number of metabolites which that have positive effect on the texture and staling of bread. The sourdough is of simple preparation as it befits of method that is thousands of years old. It includes some starter, refreshed with several times its own weight with fresh flour and lukewarm water and let fermenting for some hours to even a night until the yeast population grows. Bread is made by adding to the sourdough more flour, water and salt. Some of the mixture is kept to constitute your starter for the next batch of bread. Due to this synergistic growth of LB and yeasts, the products obtained from sourdough show more concentration of flavor, more elastic dough, and a longer shelf life than bread fermented only by bakery yeast. This technology, using sourdough, is present in Morocco in few tribes for domestic usage. This study presents updated information about types of making sourdough and the factors affecting this process. It also aimed to study breads made with sourdoughs obtained with different culture-initiated fermentations, fermentation time, different type of flour (wheat or barley), and many different starter culture cereal.

Key word: *Bread, Sourdough, Yeast, Lactic acid Bacteria.*

POTENTIAL FOR BIOLOGICAL CONTROL OF POSTHARVEST FUNGAL ROT OF WHITE YAM (*DIOSCOREA ROTUNDATA* POIR) TUBERS IN STORAGE WITH *TRICHODERMA HARZIANUM*

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Abstract

Potential of *Trichoderma harzianum* for biological control of postharvest fungal rot of white yam (*Dioscorea rotundata* Poir) tubers in storage was studied. Pathogenicity test revealed the susceptibility of healthy looking yam tubers to *Aspergillus niger*, *Botryodiplodia theobromae* and *Fusarium oxysporum* f. sp. *melonganae* after fourteen days of inoculation. Treatments comprising *A. niger*, *B. theobromae* and *F. oxysporum* each paired with *T. harzianum* and were arranged in completely randomized design and stored for five months between December, 2015 and April, 2016 and December, 2016 and April, 2017. Results revealed that tubers treated with the pathogenic fungi alone caused mean percentage rot of between 6.67 % (*F. oxysporum*) and 22.22 % (*A. niger*) while the paired treatments produced only between 2.22 % (*T. harzianum* X *F. oxysporum*) and 6.67 % (*T. harzianum* X *A. niger*). In the second year of storage, mean percentage rots were between 13.33 % (*F. oxysporum*) and 28.89 % (*A. niger*) while in the paired treatment rots were only between 6.67 % (*F. oxysporum* X *T. harzianum*) and 8.89% (*A. niger* X *T. harzianum*). Tubers treated with antagonist alone produced 0.00 % and 2.22 % in the first and second year respectively. Result revealed that there was a significant difference ($P \leq 0.05$) in mean percentage rot between the first year and the second year except where *B. theobromae* was inoculated alone, *A. niger* and *T. harzianum* paired and *B. theobromae* and *T. harzianum* paired. The most antagonised fungus in paired treatment for both years was *F. oxysporum* f. sp. *melonganae* while the least antagonised was *A. niger* and *B. theobromae*. The study recommended the use of *T. harzianum* in the control of rot causing pathogens of yam tubers in storage as better alternative ways of reducing tuber rot compared with the use of chemical fungicides which are environmentally hazardous.

Keywords: *Biological control, Fungal rot, Postharvest, White yam, Trichoderma harzianum.*

INVESTIGATION OF PSEUDOMONAS SYRINGAE ASSOCIATED WITH BACTERIAL CANKER OF PEACH IN AZAD JAMMU AND KASHMIR

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Abstract

Bacterial diseases of peach caused by *Pseudomonas syringae* is an increasing problem in Azad Jamun & Kashmir (AJK). No work has been done on so far on its pathological aspect and there is a need of preliminary studies to investigate the pathovars and races of *P. syringae*. Current study was carried out in AJK for the determination of disease incidence and prevalence of peach fruits growing areas of Poonch division (Haveli, Bagh and Sudhanoti) for first time. Almost 75% disease prevalence was calculated in district Bagh followed by 50 % in district Poonch while there was 25% disease prevalence found in Haveli and Sudhanoti. Similarly, Maximum disease incidence was 16%, in district Bagh followed by district Poonch (15%), Sudhanoti (11%) and Haveli (8%). All these results were on the basis of symptoms observed in the field and were compared with the symptoms of bacterial canker. Twenty-nine gram negative isolates having florescent colonies were recovered on King's B media showing positive levan and tobacco hypersensitive response while negative oxidase test, pectolytic activity on potato tubers and arginine dihydrolase test confirmed *Pseudomonas syringae* isolates. To refine results, molecular characterization was done using two primer sets (16s rRNA and gyrB gene). After phylogenetic analysis, it was confirmed that from 29 isolates 16 isolates were *P. syringae* pv. *syringe* while other 13 isolates were *P. syringae* pv. *morsprunorum* Race 1. The results highlighted the alarming situation of new threat in AJK, which must be further studied for its epidemiology for better management of bacterial canker of peach in local environmental conditions.

Keywords: *Pseudomonas syringae*, Pathovars, Race, Peach, Pakistan.

NEW PREDATORY MITE SPECIES OF THE GENUS *STORCHIA* (*STORCHIA SATIVAUS*) STIGMAEIDAE: PROSTIGMATA: ACARI FROM PAKISTAN

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Abstract

Mites comprise a large group of arthropods belonging to subclass acari of the class arachnida. They are biologically most diverse tiny creatures, microscopic in size and worldwide distributed in all types of abiotic and biotic habitats like plains, mountains, deserts, fresh water, salt water, springs of all kind, oceans, organic matter and litter. Mites particularly infest and damage cultivated crops, vegetables, orchards, ornamental plants, forest trees and wild vegetation. Along these mites as agricultural pest, there is a large group of predatory mites as well. The current experiment was conducted to find the predatory mite fauna of family Stigmaeidae (Acari) from Punjab, Pakistan. The holotype adult female (male unknown) of genus *Storchia* was collected from Kot Sultan (Layyah city) from lucern crop (*Medicago sativa*) and described here in this manuscript. Five (05) paratypes were collected from same locality and thirteen (13) were from another city of Sheikhpura. The description, figures, measurements and discussion of this new species is given. The collected samples were submitted in Acarology Research Laboratory, Department of Entomology, University of Agriculture, Faisalabad, Pakistan.

Keywords: *Storchia*, new species, Acari, predatory mite, Stigmaeidae.

VITAMIN D LEVEL IN GESTATIONAL DIABETIC PATIENTS FROM GAZA STRIP IN PALESTINE

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Abstract

Gestational diabetes mellitus (GDM) is described as glucose intolerance of variable intensities that begins or is first diagnosed during pregnancy. Vitamin D is a fat-soluble vitamin that plays an essential role in calcium homeostasis and the maintenance of normal function in multiple tissues. In Gaza strip vitamin D deficiency remains a common problem among pregnant women. During pregnancy low concentration of serum vitamin D is a dangerous sign and can lead to several complications. Knowledge of the relationship between vitamin D and GDM could lead to new indicators for earlier treatment of cases with GDM, appropriate management to minimize prenatal deaths and to improve the quality of life among both mother and child. To assess vitamin D status among GDM pregnant women and its relationship with some biochemical variables in Gaza strip. This case control study comprised 45 GDM pregnant women and 45 apparently healthy pregnant women. Questionnaire interviews were applied among the study population. Serum vitamin D and insulin levels were measured by ELISA, fasting blood glucose (FBG), glycated hemoglobin (HbA1c), triglycerides, cholesterol, high density lipoprotein (HDL), phosphorus and calcium were determined chemically. Blood pressure was also measured. Body mass index (BMI) and low density lipoprotein (LDL) were calculated. An approval was acquired from local ethical committee to perform this study. All data were analyzed by a computer using SPSS program. The average of vitamin D in GDM cases (29.6 ± 10.6 ng/ml) was lower than that in controls (34.5 ± 10.6 ng/ml), the difference was statistically significance ($P = 0.031$). There was an increase in the average of FBG, oral glucose tolerance test (OGTT), HbA1c and insulin levels in GDM cases (105.8 ± 15.8 mg/dl), (187 ± 25.5 mg/dl), ($7.1 \pm 0.4\%$), (20.4 ± 8.4 μ IU/ml), versus controls (66.5 ± 8.1 mg/dl), (85.8 ± 8 mg/dl), ($4.4 \pm 0.4\%$), (6.2 ± 1.7 μ IU/ml) respectively with ($P < 0.001$). Pearson correlation test showed a significant negative correlation between vitamin D and the parameters: weight ($r = -0.251$, $P = 0.017$), BMI ($r = -0.223$, $P = 0.035$), glucose ($r = -0.235$, $P = 0.026$), OGTT ($r = -0.249$, $P = 0.018$), HbA1c ($r = -0.232$, $P = 0.028$), Homeostatic Model Assessment for Insulin Resistance (HOMA-IR) ($r = -0.215$, $P = 0.042$) and phosphorus ($r = -0.401$, $P < 0.001$). On the other hand, Pearson correlation test showed a significant positive correlation between vitamin D and calcium ($P < 0.001$). Vitamin D was lower in GDM women compared to controls in Gaza Strip. Low vitamin D status may be associated with insulin resistance and act as a risk factor for GDM.

Keywords: *Vitamin D, GDM, OGTT, HbA1c, Insulin resistance, Gaza strip.*

COFFEE-ASSOCIATED PHYTOPARASITE NEMATODES (*Coffea arabica* L.) IN CUSCO - PERU

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Abstract

In 2018, coffee was the third export crop in Peru, after avocado and grape, with sales exceeding 632 million dollars. The average crop yield is low, reaching 13 qq/ha, parasitism by nematodes being a limiting factor. This study aims to identify coffee-associated phytoparasitic nematodes in La Convencion province, Cusco. 29 coffee farms, Typica and Catimor varieties, were evaluated. The sampling of soils and roots was carried out in the months of December 2016 and January 2017. At the laboratory level, the centrifugal fluctuation method with sucrose solution was used for soil samples and the centrifuge blender technique for samples of roots, biochemical and morphological characterization to identify species of *Meloidogyne* spp. Five genera of phytoparasitic nematodes associated with coffee cultivation were found: *Meloidogyne* spp., *Helicotylenchus* spp., *Mesocriconema* spp., *Dorylaimus* spp. and *Xiphinema* spp. The highest population density was observed in *Meloidogyne*, with 460 individuals/100 cm³ of soil and the lowest, in *Dorylaimus*, with 8.3 individuals/100 cm³. Populations of *Meloidogyne* and *Helicotylenchus* were found in 100% of the farms. By the isoenzyme electrophoresis method, three phenotypes were identified for *Meloidogyne exigua*: Est E1, E2 and E2a that did not present morphological differences. Nematodes must be considered in coffee pest management plans since they parasitize coffee tree roots and have high genetic variability

Keywords: *Coffee*, *Esterase phenotype*, *nematodes*, *La Convención*.

ENHANCEMENT OF WHEAT VIRUS-RESISTANCE AT APPLICATION OF THE SE NANOPARTICLES CITRATES AND CONSORTIUM OF SOIL MICROORGANISMS

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Abstract

The influence of pre-sowing seed treatments of selenium nanocitrates (SeNPs) and application of soilformed microorganism consortium (biological preparation (BP) Extrakon) on wheat plants infected with wheat streak mosaic virus (WSMV) were investigated in greenhouse and fields conditions in 2018-2019 (on territories of Zabolotny Institute of Microbiology and Virology of NASU). The pre-sowing seed treatments of 1% selenium nanocitrates (SeNPs) with application of BP Extrakon initiating the growth of juvenile wheat in laboratory experiments were found. In the field experiment on variants of WSMV-infected plants, two weeks after inoculation (tillering stage), we observed the appearance of characteristic symptoms yellow mosaic with intermittent strokes on the leaves. In the tubing phase, a lag in the growth of WSMV-infected plants in compared with intact plants was already clearly visible, which was confirmed by ELISA test. In the greenhouse conditions, in the tillering phase of wheat plant, enhancement of the quantum efficiency of PS II (F_v/F_p) of WSMV-infected plants was shown against the background of pre-sowing treatment of 1% SeNPs in combination with application of BP Extrakon compared to virus-infected plants without treatment. In the field experiments, in the heading stage, an increase in the activity of superoxide dismutase (SOD) was detected in all experimental variants at the most significant increase of the SOD-activity on the variant of WSMV- infected plants with application of BP Extrakon and SeNPs. Estimation of 1000-grain weight and grain productivity confirmed the effectiveness of the combined use of BP Extrakon with pre-sowing treatment of SeNPs on both intact and WSMV-infected plants. Thus, pre-sowing treatment of SeNPs in combination with a consortium of soil-forming microorganisms has bioprotective effect on wheat plants enhancing of resistance of cells to viral damage.

Keywords: *Wheat, WSMV, Se nanoparticles, consortium of soil microorganisms, chlorophyll a fluorescence induction.*

LEGUME COVER CROPS EFFECTIVENESS FOR WEED CONTROL IN THE MEDITERRANEAN REGION

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Abstract

The European Commission presented recently its' new strategy for the defence and preservation of biodiversity. This contemplates the adoption of a “Farm to Fork” strategy, aiming to create a sustainable production and consumption system. The EU presents measures leading to a 50% reduction in the use of plant protection products by 2030, which makes necessary the development of alternative practices such as adopting non-chemical weed management. The use of cover crop is expected to control weed infestation and reduce the need of herbicide application. The choice of cover crop species adapted to the local conditions and providing a large amount of biomass is critical as weed control capacity is linked to cover crop soil cover density. In this study held in central Portugal, 6 species of legumes (Forage Pea, Yellow Lupin, Red Clover, Balansa Clover, Persian Clover, Arrowleaf Clover) cultivated in the fall to spring period in succession with grain maize were tested and weed control performance was related with total dry matter production and soil fertility. Weed control efficiency was in fact clearly related with legumes biomass, clover species showing the best results in term of dry biomass in particular Arrowleaf and Balansa Clover with production above 8 t/ha and weed infection rating from 0 to 8% for optimum soil fertility conditions. Red clover showed also good performance although a weaker biomass production was compensated by precocity of developing. Soil fertility level was identified as an important indicator, a decrease in soil fertility led to a delay and a lower production of legume biomass compromising the effectiveness of legumes for weed control.

Keywords: *Cover crop, legumes, weed control, soil fertility.*

WHEAT AREA ESTIMATION USING NDVI TIME SERIES DERIVED FROM OLI IMAGES UNDER PIVOT SYSTEM, EGYPT

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Abstract

One of the main challenges in determining crop growth vigor or biomass from remotely sensed images is the alignment of the acquisition date of the image with the optimal crop growth period. As discussed, increasing the temporal frequency of image acquisition addresses this problem, but can be costly, especially, in the case of fine resolution (i.e. high spatial resolution) platforms. However, with Landsat being available at a relatively small cost (usually free), composite 16-day NDVI Landsat data (~30x30 m pixel size) throughout the entire crop growth period was used for this research. This ensured a continuous vegetation index profile, which captured land-use patterns (e.g. fallow, cropping) before and during the growing period of winter crops. The measured 16-day aggregated NDVI Landsat was used as temporal input for quantifying and understanding the crop growth trajectory at each pixel. Standard and advanced image processing techniques were applied to the multi-date NDVI imagery. These methods included geometric corrections, image enhancement and transformation, re-projection, supervised classification, and classification accuracy assessment. Temporal classification methodology and multi-temporal algorithms were adapted, developed and tested at the shire level in order to determine crop area planted for different crop types (e.g. wheat, sugar beets, Alfa Alfa, Potato and onion) at the end of the crop growing season as well as for early-season estimates. The efficacy of using different multi-temporal approaches to estimate end of season crop area was investigated, appreciably high accuracy was found at a pixel. Multi-temporal normalized difference vegetation index (NDVI) images obtained from Land sat 8 satellites during the season of 2018 were used to estimate crop acreage in this study. The maximum likelihood classification was used to identify the boundaries of agricultural fields and to determine the distribution of the crops. The classification results of the El-Salhia site had almost 93.1% overall accuracy and 0.91 Kappa statistics for Multi-temporal NDVI compared with 84.2365% overall accuracies and 0.80 for kappa statistics when we used the single date to estimate or discriminate crop area. From the classification results of the El-Salhia site we found that almost 35.4% of the total area was temporary unvegetated areas during the winter season. The largest vegetated area (almost 25% from the total area) was cultivated by potato followed by trees occupying 17.62% of the total area on the otherwise cereal crops (wheat, sugar beets) represented by 9.3 % and 2.66 % respectively.

Key words., *Wheat, crop Area estimation, Land sat-8, NDVI, Time series.*

SOLVING THE PROBLEM OF CONTAMINATING SMOKED FOOD WITH CARCINOGENIC COMPOUNDS OF SMOKE

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Abstract

Meat and fish smoked products, widely produced nowadays, occupy a permanent place in the mass diet. The consumption of smoked meat is estimated by FAO at 15.6 million tons in 2019 (+40 % growth over the past ten years). This is due to the increased incomes of consumers in many countries, which made meat and fish smoked products, once classified as "premium" delicacies, more accessible to the majority. There has been a shortage of high-quality raw materials, which, combined with a highly competitive food market, forces manufacturers to reduce their costs by using non-traditional raw materials. The latter leads to increased use of processing raw materials with smoke to effectively mask individual defects in taste, appearance and consistency of products. As a result, there is a carcinogenic contamination problem because of polyaromatic hydrocarbons (PAHs) presented in the smoke and smoking liquids, and the growth of cancer. PAHs are formed as a result of pyrolysis of wood during smoke generation at temperatures above 450-480 °C. Currently used smoke generators and schemes for cleaning smoke from PAHs are not effective enough, so they do not eliminate the main cause of PAH formation, uncontrolled pyrolysis. The principal solution to the problem is to develop methods and equipment for producing smoke at temperatures below carcinogenic peaks. A successful solution is the method for producing smoke with an infrared power supply, implemented in the design of IR smoke generator (IR-SG). The device allows to reliably maintain the pyrolysis temperature of wood below 450 °C. The effectiveness of the method and apparatus is confirmed by studies of products smoked with IR-SG, in which the content of Benzo(a)pyrene is less than 0.0002 mcg/kg, which is lower than the maximum permissible concentrations of this compound in food.

Keywords: *Smoked products, carcinogenic compounds, smoke generation, infrared smoke generator.*

PHYTOGEOGRAPHICAL ANALYSIS OF THE VRŠAC VINEYARDS (SERBIA) WEED FLORA

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Abstract

Application of various agrotechnical measures is the key factor defining the composition of the vineyard weed flora. Vineyard weed communities are highly diverse, due to specific environmental characteristics and frequent disturbances of these agroecosystems. Bearing all this in mind and due to a limited number of studies of the vineyard weed flora in Serbia, the aim of this research was to assess the phytogeographical characteristics of the vineyard weed flora in the Vršac vineyards. Field research encompassed the entire vegetation season (March-November) in 2016 and was performed at three localities within the area of the Vršac vineyards. Floristic analysis was done at 60 fixed 1 m² plots (48 between-row and 12 in-row plots). Phytogeographical analysis has determined that 97 weed species which were recorded belong to eight areal types. Weed species predominately belonged to the Eurasian areal type, with 49 recorded species (51%). Results have shown the presence of 14 species of cosmopolitan distribution, while the Pontic-Mediterranean areal type was represented by 10 weed species (10%). This transitional areal type was represented by four areal groups, of which the Pontic-CentralAsian-Submediterranean group was the most numerous. Of the plants typical for the Pannonian region of Serbia, i.e. the steppe species, belonging to the Pontic-SouthSiberian areal type, only two weed species (*Asperugo procumbens* and *Senecio vernalis*) were recorded. Allochthonous species (adventive areal type) were represented by eight weed species, with species originating from North America (*Amaranthus retroflexus*, *Erigeron annuus*, *E. canadensis*, *Panicum capillare* and *Xanthium strumarium* subsp. *italicum*) being dominant.

Keywords: *areal type; biogeography; floral element; Vojvodina province; Vršac vineyards.*

PRESENCE OF AFLATOXIN M1 IN MILK IN SERBIA IN 2017

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Abstract

Aflatoxins are the most widespread mycotoxins primarily produced by fungi of the genus *Aspergillus* such as *A. flavus* and *A. parasiticus*, infecting grains during storage, spaces, nuts, milk and animal feed. Even in low concentrations, they are highly toxic. Major forms of aflatoxins include B1, B2, G1 and G2. Mammals that ingest AFB1 contaminated food eliminate amounts of the main hepatic metabolite known as „milk toxin“ or aflatoxin M1 (AFM1) via milk. In this study, a total of 368 samples of raw, pasteurised and UHT milk was examined in 2017. All samples were analyzed for AFM1 by competitive enzyme-linked immunoassay, RIDASCREEN® Aflatoxin M1. AFM1 was detected in 50 out of 56 samples of raw milk (89.28%), at levels ranging from 0.04 to 2.10µg/l. Of 102 samples of pasteurized milk, 69 were contaminated by AFM1 (67.65%), at levels ranging from 0.03 to 0.199µg/l. Finally, of 210 UHT milk samples AFM1 was detected in 107 (50.95%), at levels ranging from 0.025 to 0.126µg/l. In Republic of Serbia, maximum residue limit of AFM1 is 0.25µg/kg. These results suggest that number of milk samples contaminated with AFM1 is not negligible. In addition, the level of contamination was the highest in raw milk. The occurrence of aflatoxins in raw milk and commercially available milk is one of the most serious problems, as milk is a key source of nutrients for human. Therefore, continuous monitoring over milk is necessary.

Key words: *Aflatoxin M1, milk, ELISA.*

CONTROL OF *MYZUS PERSICAE* SULZER IN PAPRIKA IN GREENHOUSE

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Abstract

In this study, the possibility of the use of imidacloprid and thiamethoxam in the control of aphids in paprika, under greenhouse conditions, was evaluated. Significant pests, such as *Myzus persicae* Sulzer (Aphididae) causes decreased growth, shriveling of the leaves and transmitting plant viruses. The trials were conducted in 2018 by standard OEPP/EPPO methods at locality Bačko Gradište (Vojvodina) in paprika crop (hybrid Ariadni) in the greenhouse. The insecticides based on imidacloprid (200 g a.i./l, SL) were applied at an amount of 0.6 l/ha and thiamethoxam (250 g a.i./kg, WG) at an amount of 0.18 kg/ha. Insecticides were foliar applied, using a backpack sprayer with water consumption of 400 l/ha. Efficacy (E%) of the insecticides was determined according to Henderson & Tilton, while the significance of differences was evaluated by LSD test (5%). Before the treatment, the average number of aphids ranged from 40.1 to 51.6 per leaf. The first day after the application of the insecticides, the number of *M. persicae* was significantly lower in comparison to the control, and the efficacy was 92.3-95.3%, while eight days after the treatment efficacy was 99- 99.4%. Fifteen days after the application, the efficacy was still high in the range of 99.4-99.8%. On the control variant during the trials, a large increase in the population of aphids was detected, which shows us the importance of its timely control, to be started by the formation of a colony. The population of *M. persicae* in the paprika crop in the greenhouses at Bačko Gradište showed high susceptibility to insecticides from the neonicotinoid group.

Key words: *paprika, greenhouse, Myzus persicae, insecticides.*

THE PRESENCE OF TOXIGENIC GENERA OF FUNGI AND THEIR MYCOTOXINS IN DURUM WHEAT IN SERBIA DURING 2018 AND 2019

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Abstract

The aim of the present study was to determine the presence of toxigenic fungi and mycotoxins in the durum wheat spikes. Their occurrence was observed in the location of Zemun Polje during two production years (2018 and 2019). Samples of two different durum wheat varieties were drawn from several plots and surface-sterilised (solution of diluted bleach and water in the ratio 1:3). Kernels were placed on potato dextrose agar (PDA) in Petri dishes. One hundred kernels were taken from each sample (10 dishes with 10 kernels). After the 7-day growth in the thermostat at the temperature of 25°C, the identification of pathogens was initiated. The following genera of fungi were established in 2018 samples: *Alternaria* (52.7% of the total number of kernels), *Fusarium* (34.16%), *Aspergillus* (5.88%), *Nigrospora* (4.5%), *Acremoniella* (1.25%), and others (1.51%). During 2019, the highest percentage (62.6%) of identified fungi belonged to the genus *Fusarium*, and then to genera *Alternaria* (29.3 %), *Epicoccum* (2.8%), *Aspergillus* (1.7%), and others (3.6%). The drawn samples were used to perform the analysis of mycotoxins for the presence of fumonisins and aflatoxins. The ELISA was applied in this analysis. The results obtained from 2018 samples showed low values for fumonisin. The values of synthesised fumonisin ranged from 0.214 to 1.316 ppm, but the values of synthesised aflatoxin were much higher and ranged from 6.052 to 15.728 ppb. The values of synthesised fumonisin were little higher in 2019 (1.066 - 4.652 ppm), but the values of aflatoxin were lower than year before (0-2.334 ppb).

Key words: *fungi, mycotoxins, durum wheat, Serbia.*

EFFICACY OF FUNGICIDES AND FERTILIZERS IN THE CONTROL OF *XANTAMONAS EUVESICATORIA* IN PEPPER

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Abstract

Bacterial spotty of peppers formerly referred to as *X.campestris* under our conditions in pepper growing areas such as Ruski Krstur, Sombor occurs regularly in field crops and is the most significant factor limiting the yields of peppers especially on some varieties. The molecular method of the various strains revealed that they all belong to the species *Xanthomonas euvesicatoria*. The first symptoms occur in the field in early July, after a rainy season, on the lower older leaves in the form of tiny dark green and moist spots. In conditions of humidity and higher temperatures, diseased tissue turns brown. The spotting occurs and large necrotic spots are formed. Lower leaves with the higher and stronger intensity of bacteriosis, yellow which can lead to decrease. At higher intensities, *Xanthomonas* infects the fruit as well, giving symptoms such as scabies. *X.euvesicatoria* is transmitted year by year through infected diseased dead tissue and through infected semen. Symptoms can occur as early as seedlings and subsequently appear more widely in the field. On the plant, bacteriosis spreads with raindrops or, if it is poured over the plants, with water. Bacteria carried by the wind are transferred from plant to plant. *X. euvesicatoria* have cilia, swim in the water and, upon reaching the stoma, infect the plant. Most varieties of peppers are sensitive to *X. euvesicatoria*. However, in field conditions it occurs regularly in areas where peppers are grown on large areas. Copper-based preparations are used to protect the peppers, which must be used frequently and since it acts only in contact, the effectiveness is relatively limited. In order to test the effectiveness of the registered preparations in the trial, we also used newer preparations in pepper protection. The experiment was performed in the PSS Sombor field experiment on the Bagoly F1 (Hungary) variety, which has elongated fruits, extremely thick meat with 3-4 chambers. The experiment had 4 variants in 3 repetitions. To evaluate the effectiveness, we used the number of spots on the experimental surface of 10 plants in three replicates. The harvest was done twice on 5.08 and 31.08.2019. We evaluated the number of healthy fruits and the total yield.

Keywords: *Xanthomonas euvesicatoria*, pepper, fungicides, fertilizers, protection.

OCCURENCE OF DEOXYNIVALENOL IN WHEAT BRAN IN SERBIA DURING 2019-2020

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Abstract

Animal welfare continues to be an important issue in the whole world. Therefore the production of safe feed remains one of the most important tasks because the consumption of contaminated feeds by livestock has been associated with a variety of adverse health effects including feed refusal, reduced weight gain, diarrhoea and emesis. Wheat bran, a by-product of the dry milling of common wheat (*Triticum aestivum* L.) into flour, is one of the major agro-industrial by-products used in animal feeding. In addition, wheat bran can also be used in human diet as a source of fiber in the preparation of high-fiber pasta, noodles etc. Deoxynivalenol (DON) is one of several mycotoxins produced by certain *Fusarium* species that frequently infect wheat, corn, rice, oats, barley and other grains in the field or during storage. In this study, a total of 72 samples of wheat bran were collected from several producers from Serbia in the period 2019-2020. The samples were analysed for deoxynivalenol (DON) content by using an enzyme-linked immunosorbent assay Ridascreen[®] Fast DON SC. The occurrence of DON in the tested samples was 100%, with average concentration 2.79 mg kg⁻¹ and maximum DON content of 9.12 mg kg⁻¹. These results suggest very high level of DON concentration in all tested samples. The limit of 8.00 mg kg⁻¹ imposed by Serbian legislation for DON content in feed was exceeded in two studied samples. However, only fourteen of them (19%) would be suitable for human consumption, due to a much lower allowed limit (0.75 mg kg⁻¹), which raises a risk for consumers.

Key words: *Deoxynivalenol, wheat bran, ELISA.*

CONTAMINANTS IN VEGETABLE OILS

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Abstract

Vegetable oils are an extremely important ingredient in a proper diet, primarily because they are a significant source of energy, essential fatty acids, minor components and liposoluble vitamins. In addition to the above, edible oils also have certain physiological functions. Edible oil is a product used to prepare food and aromas, as well as food that does not require heat treatment. Edible vegetable oils are triacylglycerols, in smaller quantities containing other minor components that are natural ingredients of the oil. They are indispensable in the preparation of meals as well as in the production of numerous food products. It is important that the oils are of high quality and shelf life in order to fulfill their multiple roles. Crude oils can also contain various contaminants such as: pesticides, polycyclic aromatic hydrocarbons (PAHs), mycotoxins, mineral oils, etc. They can be easily accumulated in the oil, during vegetation, processing and storage of raw materials (oilcrops). All these chemical contaminants and their metabolites are: carcinogenic, teratogenic and immunotoxic, having a significant impact on human health. Therefore, more and more attention is paid on analytical methods for their determination. The risk of contamination and its type depends on the type of oil and its origin. Information on their presence in different oils is collected in three ways: by monitoring all phases of crude oil production, testing of crude oil and disseminating information on contaminants in oil production and science. These contaminants are removed at different stages of the refining process. Therefore, these components should not be present in refined edible oils.

Keywords: *Edible oils, Pesticides, Polycyclic aromatic hydrocarbons (PAHs), Mycotoxins, Refination.*

RISK OF INTRODUCTION OF QUARANTINE ORGANISMS: CASE *CLAVIBACTER MICHIGANENSIS* SUBSP. *SEPEDONICUS*

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Abstract

Transmission of plant pathogens and pests across country borders has raised an alert in the EU. Some of them having a severe economic impact, leading for taking precautionary measures such as quarantine of plant materials transported across borders. *Clavibacter michiganensis* subsp. *sepedonicus* (*Cms*) is listed as a quarantine organism in EU. This bacterium causes potato ring rot disease and presents a worldwide threat due to crop losses during vegetation and in storage. Potato tubers from import in Serbia were tested for its presence in accordance with the official EU Council Directive. From the stolon end of 200 tubers (consist one sample), the small core of tissue containing vascular tissue was removed and the heel ends were taken and crashed in sterile phosphate buffer, then centrifuged. Re-suspended pellet was used for immunofluorescence (IF, Loewe Biochemica GmbH), isolation of bacteria and DNA extraction for Polymerase Chain Reaction (PCR) performed with a pathogen-specific primer set PSA-1/PSA-R. As a positive control *Cms* reference strain CFBP 3561 was used. Two samples of ware potato originated from Belarus and Russian Federation in 2019 gave positive results for the presence of *Cms*. Visible internal symptom was observed on several tubers, in form of the vascular ring of tuber when they cut transversely. Bacterial ooze stream when tubers squeezed. The isolation of bacteria was performed from the ooze on Nutrient dextrose agar. Creamy-white, smooth colonies were formed after 3-5 days of incubation at 22 °C. Restriction fragment length polymorphism (RFLP) of PCR products performed with PSA-1/PSA-R primer pair (502 bp) with enzyme *Bgl*III (fragments 282 and 220 bp in size) confirmed that the isolates belong to *Cms*. Pathogenicity was confirmed on aubergine seedlings, showing typical wilting obtained within 15-20 days after inoculation. Serbia is still free area from *Cms* pathogen due to rejection of contaminated potatoes from import.

Keywords: *health status, plant, disease, bacteria.*

EFFECTS OF COVERING FIELD AND MEASURES IN CONDITIONS WITH EXTREMELY HIGH TEMPERATURES

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Abstract

Nowadays, the living world is faced with an enormous number of threats and major climate change. This will have significant consequences on the spread of plants, their growth and development. High temperature and stress in plants significantly alter the life cycles of plants. In order to reduce the negative impact of high temperatures, authors set up experiment with peppers and tomatoes at the Agriculture advisory service "Sombor" field in West Bačka District of the Autonomous Province of Vojvodina (Serbia) during two years 2017 and 2018. We set up 7 variants (control 1, control 2, black foil with plants, black foil with hay, black foil with straw, soil without foil with hay, soil without foil with straw). During the test we measured the temperature every day from 10 July to July 31 between 08:00 and 16:00 (08:00,10:00,12:00,14:00,16:00). We measured the temperature of the soil with a digital thermometer, the temperature above the surface of the soil and measurement using an automatic weather station. The results in 2017 and 2018 showed significant reductions in soil temperature in straw and hay variants relative to controls. In addition to measuring temperature, we also measured the results of tomato and pepper yields, where variants with straw and hay significantly increased the yield. This way of soil formation is one of the measures to overcome the problems that arise in extremely high temperatures.

Keywords: *high, temperatures, measuring, foil, straw, hay.*

ON THE HEARTCUT 2D-GC SEPARATION OF CHIRAL VOCS PRESENT IN SLOVAK TOKAJ WINES

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Abstract

Wine, as natural product, consists of chiral compounds. Moreover, enantiomers of these chiral compounds shall be present in some specific ratio that depends on numerous factors: the technology of production process, variety of grapes or their geographical origin. This fact can be used for evaluation of wine authenticity, geographical origin or possible adulteration etc. Slovak Tokaj wine types are the best known in Slovakia and have a protected designation of origin. This is due to the fact that Slovak Tokaj wine types are produced by special technology that includes the use of noble rot grapes -healthy grapes infested with noble mold *Botrytis cinerea*. This mold causes synthesis of new compounds and degradation of present compounds in grapes and is responsible for typical aroma and taste of Tokaj wine types. However, there is a lack of information about enantiomer composition of chiral compounds, present in these wine types. Thus, the aim of this work was to characterize the composition of Slovak Tokaj wine types with the focus on specific enantiomer ratios of chiral VOCs. For this purpose, heart cut two-dimensional gas chromatography (heart-cut 2D-GC) was used to avoid problem of coelution of target compounds. In first dimension of GC-GC-MS-FID system, polar DB-FFAP column was used, while in second dimension chiral columns were used depending on target compound. For chiral separation of limonene, linalool, hotrienol and α -terpineol, Chirasil- β -Dex column was used. Chiral separations of 2,3-butanediol, diethyl malate and whiskey lactone were performed on MEGA-DEX-DMT-Beta column. Deans' Switch provided switching between first and second dimension. Extraction of VOCs from wine was performed by SPME procedure with using PDMS/CAR/DVB 50/30 μ m SPME fiber.

Keywords: *Tokaj wines, SPME, heart cut 2D-GC, chiral separations.*

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ASPERGILLUS FLAVUS BIOMASS IN MAIZE AND USE OF A BIOCONTROL STRATEGY TO LIMIT AFLATOXIN PRODUCTION

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Abstract

Aspergillus flavus colonization of maize can produce mycotoxins that are detrimental to both human and animal health. Screening of maize lines resistant to *A. flavus* infection together with a biocontrol strategy could help minimize subsequent aflatoxin contamination. We developed a qPCR assay to measure *A. flavus* biomass and showed that two African maize lines, GAF4 and KDV1, had different fungal loads for the aflatoxigenic isolate (KSM014), fourteen days after infection. The qPCR assay revealed no significant variation in *A. flavus* biomass between diseased and non-diseased maize tissues for GAF4, while KDV1 had significantly higher *A. flavus* biomass ($P < 0.05$) in infected shoots and roots compared to the control. The biocontrol strategy using an atoxigenic isolate (KSM012) against the toxigenic isolate (KSM014) showed aflatoxin production inhibition at the co-infection ratio, 50:50 for both maize lines (KDV1 >99.7% and GAF \geq 69.4%) as confirmed by bioanalytical techniques. As far as we are aware, this is the first report in Kenya where the biomass of *A. flavus* from maize tissue was detected and quantified using a qPCR assay. Our results suggest that maize lines that have adequate resistance to *A. flavus* together with the appropriate biocontrol strategy could limit outbreaks of aflatoxicoses.

Key words: *Mycotoxins, Aspergillus flavus, Maize lines, qPCR, bioanalytical, biomass.*

DESIGN AND DEVELOPMENT OF A STANDARD VARIABLE-RATE SPRAYER SYSTEM FOR SELECTIVE WEED TREATMENT

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Abstract

Weed composition and density play an important role in decision-making processes. By combining computer vision systems with Decision Support Systems (DSS) we can create implements able to apply weeding treatments selectively. In the current project, a weed selective application method using ISOBUS communication has been developed. To achieve this, a recognition component and a decision component have been designed which will be able to control the sprayer, through the ISOBUS. Until now, section-controlled sprayers can be controlled through a predefined command map. By integrating a weed map or even better an online vision system able to detect weed species, the sprayer can be ready to apply herbicides site specifically. The system aims at identifying the weed composition and density in a predefined grid cell configuration. If the weed density exceeds predefined values relevant to the economic threshold then the complete cell will be sprayed, otherwise, it will not. With this information, it creates a matrix of ones and zeros which will allow the main program to know whether it has to power on the valves or not. One of the big advantages of the proposed method is the generic sprayer controlling through the ISOBUS standard. That makes the system independent from a specific sprayer, requiring only ISOBUS-ready sprayers capable of section control. When the on-line system is working sensor data deriving from cameras will provide the input to a Neural Network to discriminate crop plants and weeds. Instead of a predefined weed map, the information will be sent directly through the ISOBUS to the sprayer for site-specific spraying.

Keywords: *DACWEED, EIT-FOOD, ISOBUS, Precision Agriculture.*

MACHINE VISION AND MACHINE LEARNING TECHNOLOGIES IN AGRICULTURAL APPLICATIONS

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Abstract

Image processing and computer vision applications have increased significantly in recent years. Many applications using machine vision and machine learning technologies have been developed in agricultural sectors. Machine vision and machine learning technology can be used in all stages of agricultural production, from soil preparation to post-harvest processes. In this study, machine vision, machine vision components, working principles, machine learning and learning techniques were investigated. Also application of machine vision and machine learning in agriculture were evaluated in this study with more attention to agricultural crops classification according to their external and internal quality.

Keywords: *Machine vision, Machine learning, Internal quality, External quality.*

MICROBIOLOGICAL CONTROL OF CARPOCORIS FUSCISPINUS (HEMIPTERA: PENTATOMIDAE), A PEST OF ONION AND LEEK SEED CROPS

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Abstract

Any agricultural production requires the prior production of seeds, carried out by specialized companies, which own in-depth knowledge of seed crops as well as of their pathogens and pests. These pathogens and pests often remain unknown to the agricultural world. They are very little studied and control strategies do not exist. The present study is typical of such a situation: Zollinger Bio, an organic seeds producer, regularly deals with seed crops health problems. Over the last years, the production of seeds of onion (*Allium cepa*) and leek (*Allium ampeloprasum* var. *porrum*) has been reduced by 50% by a bug, morphologically and genetically identified as *Carpocoris fuscispinus*. Their piercing-sucking mouthparts allow these insects to empty the maturing seeds. *Carpocoris fuscispinus*, a native bug in Europe, has never been considered as a pest, although observed once as a cereal pest in Iran. The pest has already caused damage during flowering making the use of insecticides not possible, because of their harmful effect on pollinating insects. Entomophagous fungi could be an alternative. Two fungal isolates, *Beauveria bassiana* UASWS 1427 and *Paecilomyces fumosoroseus* UASWS 1457, were tested against *C. fuscispinus*. The experimental units consisted of five bugs in a box with water and food (leek flower, spelled crop seeds). The mortality increased quickly between day four and day eight and reached 100% adults for *B. bassiana* and 90% for *P. fumosoroseus* at day eight. Similar results were obtained on larvae. These results are promising of a possible microbiological control against *C. fuscispinus*.

Keywords: *Beauveria bassiana*, *Carpocoris fuscispinus*, entomophagous fungi, organic agriculture, *Paecilomyces fumosoroseus*.

INFLUENCE OF ENVIRONMENTAL FACTORS ON *SCAPHOIDEUS TITANUS*, VECTOR OF FLAVESCENCE DORÉE IN GENEVA (SWITZERLAND)

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Abstract

The Leafhopper of Flavescence dorée, *Scaphoideus titanus*, (Hemiptera: Cicadellidae), native to North America, was introduced to Europe in the mid-20th century and is reported in 13 European countries, including Switzerland, where it was detected for the first time in 1967 in Ticino and in 1996 in Geneva. In Europe, *S. titanus* is subservient to *Vitis vinifera*. This insect does not cause any significant damage to grapevine, but is the main vector of the Flavescence dorée (FD), a quarantine disease, caused by *Candidatus* Phytoplasma vitis, a phytoplasma of the 16Sr-V ribosomal group. First observed in Switzerland in 2004 in Ticino, it has since spread to the entire vineyard in Ticino. In 2015, FD was identified in the cantons of Vaud, Valais and Graubünden, meaning an extension of the disease. Better understanding of FD epidemiology requires to identify the factors influencing the occurrence and abundance of its vector. Here we studied the distribution of *S. titanus* in Geneva vineyards and identified the biotic and abiotic factors, which could influence its occurrence. Various data were collected in the field and analysed using three different complementary statistical methods. *S. titanus* was present in all sampled plots and was distributed through the entire vineyard. Its abundance differed according to the orientation of the lines and decreased with the slope of the plot. Its density was higher when the viticultural area was important in the environment. During surveys of *S. titanus*, it is therefore recommended to sample very sunny plots in the middle of large vineyards.

Keywords: *Flavescence dorée*, *Geneva*, *Scaphoideus titanus*, *Vitis vinifera*.

DEVELOPMENT OF COMMUNITY-BASED HEALTH EDUCATION PACKAGE FOR THE CONTROL OF *T.SOLIUM*/CYSTICERCOSIS IN TANZANIA

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Abstract

Current *Taenia solium* cysticercosis (TSCT) control relies, among others, on proper pig management, sanitation/hygiene, and meat inspection. However, these control methods alone seem to have limited effect. Few studies conducted so far in other parts of the world, indicate that a health education package developed and implemented with community participation can address the problem. However, there is no community-based health education package in place to address TSCT in sub-Saharan Africa including Tanzania. The present work developed a community-based health education package for controlling TSCT in Mbulu, Mpwapwa, Mbinga and Rungwe districts. To identify potential TSCT infection risks and formulate key messages for the health education package development, an extensive community-based mixed methods approach was used. Formative research method was used to develop the health education package. A questionnaire survey and household observation of 483 households was conducted to assess knowledge, attitude, and practices (KAP) regarding TSCT. For triangulation purposes, 12 Focus Group Discussions (FGDs) and 38 in-depth interviews (IDIs) of key informants were conducted and analysed using Atlas ti 8. Data from the questionnaire survey were analysed using IBM SPSS software. The general knowledge of transmission, health effects, prevention and treatment of TSCT was poor across all four districts. Significant risk practices, include drinking untreated water, free-range pig management, not washing hands after visiting toilets, and undercooking of pork. These results were confirmed with those from FGDs and IDIs. As such, a community-based education package was developed that comprised the following components; (1) KAP on transmission, health effects and control measures (2) proper pork cooking and general food handling practices (3) pig husbandry practices (4) general sanitation/hygiene practices. The findings indicate low knowledge regarding TSCT in the community and the presence of infection risk practices for TSCT endemicity. Therefore, a community-based health education package was developed using the key messages formulated from the potential infection risk.

Keywords: *Taenia solium*, cysticercosis, health education package, Tanzania.

CHEMICAL COMPOSITION AND NUTRITIVE VALUE OF CAROB PULP (*CERATONIA SILIQUA L.*) COLLECTED FROM VARIOUS LOCATIONS IN THE NORTH AND THE CENTRE OF TUNISIA

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Abstract

Carob as a food for animals has been used since early times. Nowadays it is still used in small ruminants feeding in some countries of the Mediterranean basin from where the fruit originates. In the current study, we investigated the chemical composition and the nutritive value of several varieties of carob pods from different regions of Tunisia. In this context, ten samples of carob were collected from September to October 2019, in different areas distributed over different bioclimatic stages of the North and the Centre of Tunisia (*Jendouba, Siliana, Ariana, Ben Arous, Sousse, Kerouane, Nabeul, Béja, Bizerte* and *Zaghouan*). Chemical composition of samples (dry matter, ash, crude fat, crude protein; AOAC, 1984) and cell wall constituents (Neutral Detergent Fibre; NDF, Acid Detergent Fibre; ADF and lignin ADL; were determined. Also some secondary compound were evaluated (total phenolic compounds and total flavonoids. The *in vitro* gas production kinetics was determined following the technique described by Menke and Steingass (1988). Results showed that DM contents of Tunisian carob pods ranged from 88.04 (Kerouane) to 91.18 (Nabeul) g/100g. CP contents varied between 2.65 (Siliana) to 6.23 (Ben Arous) g/100g. Ash values varied from 1.95 (Siliana) to 2.82 (Kerouane) g/100g, while Crude fat content were very low (0.24 in Kerouane and Tabarka to 1.35g/100g in Ben Arous). Concerning cell wall composition, relatively high levels of NDF were observed in all samples (24.36 vs. 35.58 g/100 g), with a high level of ADF content (15.68 – 25.14 g/100g DM). Total phenolic contents ranged from 2.20 to 4.92 g GEA/100g DM and flavonoids contents varied from 69.04 to 197.23mg RE/100 g DM. Potential gas production at 24 h ranged from 55.95 (Ariana) to 70.61 (Beja) mL/300mg DM. It was concluded that Tunisian carob pods contained high level of sugar and dietary fibers but low protein and lipid contents. Therefore carob pods could represent a potential energy source for sheep. Protein supplementation will be required when carob pods is included into ruminant.

Keywords: *Ceratonia siliqua L., Tunisia, chemical composition.*

EVALUATION OF TUNISIAN MELON GENETIC RESOURCES TO BIOTIC STRESS UNDER GREENHOUSE CONDITIONS

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Abstract

*Melon crops in the Mediterranean basin are affected by several pathogens and pests that reduce yield considerably. Powdery mildew caused by the fungus *Podosphaera xanthii* and the aphid *Aphis gossypii*, vector of important non-persistent viruses, stand out among them. Safe guarding the melon production requires to tackle these biotic stress, either by chemical control measure or by developing resistant cultivars with the latter being the most sustainable, inexpensive and environmentally friendly approach. The objective of the present work was to evaluate 45 Tunisian melon accessions for resistance/tolerance to *P. xanthii* and *A. gossypii* using phenotypic screening under natural infection in greenhouse conditions in the Experimental Station of Sahline. Disease incidence and leaf curling were evaluated for Powdery mildew and aphid symptoms, respectively. The results showed that 4 accessions were highly resistant and 11 accessions were moderately resistant to *P. xanthii*. Nine accessions were tolerant to *A. gossypii* as they did not show any curling symptoms. The resistant accessions identified could be useful to be used directly by local farmers or as sources of resistance in breeding program. The determination of the genetic control to *P. xanthii* and *A. gossypii* in these accessions must be carried out by performing crosses between susceptible and resistant ones. In addition, race-specific marker related to specific resistance should be developed for *P. xanthii* resistant accession.*

Keywords: *Aphid, Genetic resources, Powdery mildew, Resistance, Sustainable.*

ACTUAL PEST STATUS OF THE BLACK PARLATORIA SCALE *PARLATORIA ZIZIPHI* (LUCAS, 1853) (HEMIPTERA: COCCOMPORHA: DIASPIDIDAE)

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Abstract

The Black Parlatoria Scale (BPS) *Parlatoria ziziphi* (Lucas, 1853) (Hemiptera: Coccothraupidae: Diaspididae) is a serious citrus pest, and has the potential for establishment and spread, and for economic consequences in the citrus growing areas. Pest status dynamic and spread history of the scale insect is reviewed. Incidence of *P. ziziphi* is usually associated with host plant, warm climate and control program adopted by national authorities. BPS was not a key insect pest of citrus in many countries until the 1970s. The pest has been established on citrus as primary host in Asiatic areas (China, Iran and Taiwan) and then has spread within the crop expansion to different areas through the trade movement of citrus plant materials. The pest is established where citrus is grown, in more than 90 countries across four continents. Nowadays, severe outbreaks of the pest are reported in the southern Mediterranean countries, reaching major pest status. Pest impact is more noticeable in North Africa, Algeria, Egypt, and Tunisia, which have recorded complicated control status. Potential future research lines should be delineated for BPS control in the newly invaded citrus areas. An integrated management approach should be developed and accurately applied in citrus orchards, focusing on monitoring techniques and biological control.

Key words: *P. ziziphi*, citrus, distribution, Mediterranean countries.

DISCRIMINATION OF MARINE OIL SUPPLEMENTS WITH DIFFERENT FEATURES BY USING MULTIVARIATE CALIBRATION APPROACHES AND ATR-FTIR

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Abstract

Today, marine oil (MO) supplements are one of the most consumed dietary supplements in the World. Eicosapentaenoic (EPA, 20:5^{5,8,11,14,17}) and docosahexaenoic (DHA, 22:6^{4,7,10,13,16,19}) acids, having beneficial effects on human health are, one of the most important omega-3 (n-3 or ω3) long-chain polyunsaturated fatty acids (PUFAs) and they have been recognized as essential ingredient to the human diet. One of the most important sources of EPA and DHA is MOs. For this reason, MO supplements have expanded in recent years and omega-3 supplements from MO have become one of the popular dietary supplements. Due to this high demand for these supplements, control analysis methods to ensure both label accuracy and product quality are of great importance in terms of protecting consumers who consume these products. One of the most important of these control analyses is the discrimination of MOs. For the discrimination of MOs, the types and quantities of the bioactive components it contains are examined by chromatographic methods. Although these methods give precise and accurate results, they take a long time, they are very chemical and expensive. With this study, ATR-FTIR was employed to classify MOs from different brands, and an environmentally friendly, fast and economic analysis method that does not destroy the sample, was developed. The ability of the spectroscopic methods tested to classify 18 different brands of MO samples was compared using the principal component analysis (PCA), one of the multivariate calibration methods. Based on the results obtained, the model developed using ATR-FTIR spectroscopy was able to classify 18 different MO samples with the highest principal component (PC) separation scores (PC1: 82%, PC2: 13%).

Keywords: *ATR-FTIR, Discrimination, Marine oil, Spectroscopy, PCA.*

THE EFFECTS OF USING JUNIPER (*JUNIPERUS COMMUNIS*) EXTRACT ON THE CHEMICAL AND TECHNOLOGICAL QUALITY OF CHICKEN BREAST MEAT

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Abstract

Lipid oxidation reactions are mostly responsible for the deterioration of chicken meat quality due to fatty acid composition or processing applications. These reactions should be retarded as much as possible by adding antioxidants to the meat during the production or process. Therefore, in the present study, the injection of juniper (*Juniperus communis*) extract at 0% (C), 0.5% (J0.5), 0.75% (J0.75), and 1% (J1) into the marination solutions was applied to chicken breast fillets during refrigerated storage for 14 days. Chemical composition of marinated chicken fillets was not significantly affected by the addition of juniper extract. The highest marination uptake ratio was found in J0.5 samples. However, the marination uptake ratio decreased with the increased extract addition level. The initial and final pH values of the fillets ranged between 6.09-6.25 and 5.94-6.29 respectively. The highest initial pH value was recorded in C samples, while J0.75 sample had the highest pH value at the end of the storage. TBARS values of all treatments were similar on day 0. However, the use of 0.5% juniper extract led to the lowest TBARS value after 7th day of storage. As a conclusion, the 0.5% addition of juniper extract may decelerate the oxidative reactions without damaging the chemical and technological quality features of marinated chicken breast meat.

Keywords: *Chicken breast meat, Juniper, Marination, Oxidation.*

PESTICIDE APPLICATION ATTIDUTES OF OLIVE GROWERS IN BURSA PROVINCE (TURKEY)

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Abstract

Bursa olive growers, generally, prefer use of chemicals to control the olive pests. Many of these chemicals have significant acute or chronic adverse effects on target organisms as well as on human. This survey was conducted to measure the level of awareness of olive growers on environmental and occupational safety in Bursa province in 2017 and 2018. A specially designed 21-item questionnaire which contained four sections about personal protective equipment (PPE) use, proper use of pesticide, environment and human health were filled out by the growers at a face to face meeting. To evaluate the effect of education, age and agricultural practice types on pesticide application attitudes of growers, some demographic questions were also asked. According to survey results, majority of growers decided to spray pesticides against pests, when they observed damage symptoms at certain critical stage. While more than a half of producers used glove and mask, the rate was found very low about wearing glasses (18%), overalls (19%) and caps (40%). It was also determined that the number of farmers having knowledge about the negative impacts of pesticides on the environment and human health was about 69 and 65%, respectively. Among the questions about pesticide application methods, more than a half of the producers were failed giving the correct answers to questions about pollution of public water sources and taking care pollinators. In this study, it was determined that the levels of education and agricultural practice types (good agricultural practices, organic farming) affected the pesticide application attitudes of olive growers. In conclusion, further education and training activities about occupational and environmental safety targeting olive growers in Bursa are essential.

Keywords: *Environmental safety, occupational safety, pest management, pesticide, survey.*

INTEGRATED MANAGEMENT OF PESTICIDES AND LIABLE EXPOSURE WITH MACHINERY EXECUTING NEEDED TREATMENTS 4.0 “IMPLEMENT 4.0”

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Abstract

Digital Farming as we see it has the potential to revolutionize agriculture, and bring significant benefits for farmers and the society overall, as we need new ways to grow more food more sustainably. Concretely, it means applying new technologies such as data science, advanced sensors in the field and from space, digital communication channels, and automation on the field. This way more and more farmers have access to better insights to take more optimal decisions, drive up yield, reduce using pesticide etc. **Integrated Management of Pesticides and Liable Exposure with Machinery Executing Needed Treatments 4.0”** project shortly named **IMPLEMENT 4.0** project is supported by European Union under Erasmus+ Vocational Education Key Action 2 within the scope of Strategic Partnership Projects for Innovation Development. The project aims to develop awareness and competences of farmers, students and other target groups involved in the Agricultural Knowledge Innovation System towards an advanced digital knowledge focused on smart farming oriented to a Vocational and Education Training framework fostering sustainable development in rural areas, strengthening professional handling of digital data and implements of sprayers for sustainable farming and delivering added value to occupability of youth in rural areas. The project aims also at creating a complete e-learning system based on digital farming linked to use and planning of plant protection machinery targeted to farmers, agricultural knowledge advisory services, higher education and agricultural vocational schools, agricultural machinery manufacturers, professionals of the vocational education and training, policy and decision makers and experts of the agricultural sector.

Keywords: *digital farming, smart agriculture, sprayers, plant protection, pesticides.*

APPLICATION OF UNMANNED AERIAL VEHICLE TECHNOLOGY IN PLANT DISEASES DETECTION

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Abstract

The application of unmanned aerial vehicles (UAV) in corporation with remote sensing technology is a very promising branch of technology nowadays, and it offers the potential to collect detailed spatial information in real time at relatively low cost. UAV with remote sensing (RS) data have been frequently cited as a rapid, safe, non-destructive, and cost-effective tool for plant disease detection in different contexts and in different types of plant species. UAV technology has been used in agriculture with image processing technologies for variable purposes including; detection, monitoring, and identification of weeds and plant diseases, estimating the expected yield of agricultural products in their various stages of development. Accurate estimates of disease symptoms, the level of disease severity, and the negative effects of diseases on the quality and quantity of agricultural products are important for field crops, horticulture, plant breeding, and for improving the efficiency of fungicide, herbicide, and insecticide, as well as for basic and applied plant research. Since pest control usually consists of taking decisions based on; the level of infestation, the development stage of the plant, timely assessments of plant disease occurrence and disease spread, In this study; studies in crop disease detection with unmanned aerial vehicles technology and remote sensing as a challenging area that can have significant economic and environmental impact on crop disease management were provided, traditional disease detection methods were discussed, comparison between the traditional methods that used for crop disease detection and unmanned aerial vehicles remote sensing based methods, limitations faced by unmanned aerial vehicles technology, overview of current sensor technologies used for the automated detection and identification of plant diseases, and the benefits obtained as a result of using these new technologies were discussed.

Keywords: *Remote sensing; UAV; Disease detection; sensor.*

PHYLOGENETIC ANALYSIS OF UKRAINIAN ISOLATE OF RASPBERRY LEAF BLOTCH VIRUS

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Abstract

Raspberry leaf blotch virus (RLBV) is a new member of the *Emaravirus* genus (*Fimoviridae*, *Bunyavirales*). Representatives of this family are characterized by a segmented "-" RNA genome, helical nucleocapsid and enveloped spherical or pleomorphic virions 80-120nm in diameter. Transmission of these viruses is carried out by eriophyid mites. The virus is widely distributed in Europe. In this paper, the phylogenetic relationships between the Ukrainian RLBV isolate and isolates from the other countries from the GenBank database were investigated. Samples of symptomatic raspberry plants were selected for the work. Total RNA was isolated and RT-PCR was performed using primers to the region of the nucleocapsid protein (P3) gene. The resulting amplicon with a length of about 500bp was sequenced. Sequences were analyzed using BLAST and MEGA7 programs. As a result of BLAST analysis, it was shown that the Ukrainian isolate of RLBV has a high similarity to some Finnish, British, Serbian and Slovak isolates (93-99% similarity). Nevertheless, the dendrogram constructed in MEGA7 did not distribute these isolates in a separate cluster. Interestingly, sequences of isolates from Finland, Britain, and the Balkans were segregated into different parts of the phylogenetic tree. This pattern can be explained by the low divergence of the virus population or small number of isolates in the database.

Keywords: *Raspberry leaf blotch emaravirus, raspberry, Ukraine.*

EPIDEMIOLOGICAL PATTERNS, PREVALENCE AND SEASONAL DYNAMICS OF DIFFERENT VIRUSES IN SUSCEPTIBLE CUCURBIT CROPS

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Abstract

Vegetables represent valuable food source and are cultivated worldwide. Cucurbits are of great importance for farmers, and viruses endanger their profitable production. Monitoring of vegetable viruses in Ukraine showed that cucumber mosaic virus (CMV), zucchini yellow mosaic virus (ZYMV), and watermelon mosaic virus (WMV) were the most harmful and common viruses in reference regions. This work was focused on establishing sources of virus introduction and/or maintenance in a population of susceptible crops, as well as on assessing relative changes in virus-infected symptomatic plants during the vegetative season in open field conditions. Samples were collected based on visual symptoms on leaves and fruits. For virus indication, commercial DAS-ELISA kits for CMV, ZYMV, and WMV were used (Loewe, Germany). Following this work, epidemiological patterns for viruses infecting vegetable crops based on their biological properties were discovered. Seed transmission was confirmed as an important way of spreading of ZYMV and CMV, and often neglected source of viruses in the ecosystems requiring special control for pathogens with wide host range (CMV). CMV was the commonest virus found in symptomatic plants (21%) followed by ZYMV (14%) and WMV (8%). A large portion (18%) of mixed virus infection was typically induced in Ukraine by the following virus groups: CMV/ZYMV, CMV/WMV, ZYMV/WMV, and rarely CMV/ZYMV/WMV. Field experiments showed steep decline of healthy plants from the end of May until the end of August, in parallel to an increase of virus-infected cucurbits. CMV was detected starting from the beginning of the experiment. Similarly, WMV was also found during the duration of screening with sharp increase of diseased plants by the end of the season. ZYMV was detected only in July with subsequent decrease in the number of ZYMV-positive samples as opposed to WMV. Artificial ecosystems were demonstrated as important factors maintaining populations of viruses infecting vegetable crops.

Keywords: *cucumber mosaic virus, zucchini yellow mosaic virus, watermelon mosaic virus, cucurbit, Ukraine.*

COMPARATIVE ANALYSIS OF INDIVIDUAL PHENOLIC COMPOUNDS IN COMMERCIAL TYPE OF STRAWBERRIES, RASPBERRIES AND BLACKBERRIES

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Abstract

Biologically active components such as polyphenols are becoming an area of interest in the research of many scientists. Furthermore, polyphenols have a very important role as functional foods in our nutrition having many effects on prevention and protection from several specific diseases i.e. certain polyphenols can stop several diseases' development via certain mechanisms. This research paper aims to identify and quantify individual polyphenolic components in the commercial type of strawberries, raspberries, and blackberries. In the study conducted in 2019, different commercial types of fruits were purchased in retail stores in Atakum, Samsun-Turkey. Analyses were performed in Amasya Central Research Laboratory. Identification and quantification of biologically active components, individual polyphenols, were carried out by the Ultra Fast Liquid Chromatograph system technique. Detection occurred at 280 nm and 520 nm. The levels of individual phenolic compounds were compared; Catechin 6,57 mg/100g was the dominant individual phenol in strawberries and caffeic acid was in the dominant individual phenol in blackberries 21mg/100gr and raspberries 29,19 mg/100g. The obtained results confirmed that the examined fruit species were rich in biologically active substances, polyphenols, and, as such were welcome on greengrocers shelves and recommended for daily consumption.

Keywords: *individual polyphenols, strawberries, raspberries, blackberries, functional food.*

IMPACT OF GEOGRAPHIC ORIGIN ON COCOA BUTTER CRYSTALLIZATION: I. 3 DIFFERENT COUNTRIES

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Abstract

Cocoa butter (CB) is an essential ingredient of chocolate and has a direct influence on the consumer relevant characteristics of this globally consumed product. The crystallization properties of CB influence the tempering process, a necessary step in the production of quality chocolate. The composition and hence the hardness of CB can vary considerably depending on the geographic origin, particularly with the environmental temperature at the time of maturation of the beans. Additionally, aroma compounds as they exist in fine cacao (e.g. Colombia) can influence crystallization behaviour. Besides, CB composition can influence the delivery of those aroma compounds. Mastery of crystallization behaviour is key for the process of tempering, which is necessary for high-quality chocolate. We studied the influence of the environmental temperature at the time of maturation of the beans on the crystallization of CB. We compared CB from three distinct locations in Ivory Coast, Peru, and Colombia with commercial-grade CB. Differential scanning calorimetry and X-ray diffraction were used to monitor and compare the crystallization behaviours of known origins obtained after different thermal treatments. The results show a notable physicochemical difference between the different CBs. Notably, they differ in their final melting points but we can follow different melting behaviour indicating differences in composition. We were able to compare composition data with physicochemical properties. The findings encourage further experimentation with the knowledge of the CB agronomic practices, which are perfectly identifiable, to understand precisely the influence of these agronomic parameters on the crystallization of CB.

Key words: *Thermal analysis, geographic origin, cocoa butter, lipid crystallization, CB polymorphism*

VALORIZATION OF CAROB FLOUR

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Abstract

The main product of the carob tree is locust bean gum - produced mainly in Spain - the leading producer. Its use is widely spread due to its use in the food industry. However, the gum production provides a lot of potentially recoverable waste. One of these wastes can already be considered as a co-product. It is already established in a niche market as carob powder or carob flour. The degree of specification of this co-product is rather vague and sometimes it is even mixed with locust bean gum powder; hence, its processing qualities and the ability for the use in transformed products are not characterized from a scientific point of view. The presented project is based on the substitution potential of carob flour due to its "nutty" taste, but also its potential nutritional value (low sugar, gluten-free). The valorization of carob flour is centered around the characterization of it from an equitable point of view, but also the use of transformation expertise. The product innovations aim to promote Very Small and Medium Enterprises (VSME) to boost the economic tissue and combine local development of the product made from locust carob flour in combination with local products. The applications are multiple, but are oriented towards the development of a scientific characterization of the by-products of the carob tree (carob flour) to allow the introduction in pastries and biscuits with joint knowledge of artisans and local products. Also, concerning the design of new products and processing, more globally this type of project represents addition of added value in the South as in the North. This vision of development of ethical, fair trade and valorization of local products could be transposable concerning the development of other products.

Key words: *carob flour, local development, local product.*

DESIGN OF AN ONLINE ARTIFICIAL NEURAL NETWORK SYSTEM FOR SELECTIVE WEED TREATMENT

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Abstract

Recognition between crop plants and weeds is a necessary component for various aspects of precision farming from on the spot herbicide spraying till robotic weeding and precision mechanical weed control. By combining computer vision systems with Decision Support Systems we can create implements able to apply weeding treatments selectively. The high variability in the agricultural conditions in combination with the continuous changing on the growing plants makes plant recognition and classification a challenging task. During the last years a lot of different methods have been proposed, yet more improvements need to be made on this problem, concerning speed, robustness and accuracy of the algorithms and the recognition systems. Digital cameras and Artificial Neural Networks have been rapidly developed during the past few years, providing new methods and tools also in agriculture and weed management. Through a large amount of data inputs, and a process of learning, they are able to identify attributes and characteristics, quite subtle and previously un-identified. In the current work images gathered by an RGB camera of *Zea mays*, *Alopecurus myosuroides*, *Amaranthus retroflexum*, *Avena fatua*, *Chenopodium album*, *Echinochloa crus-galli*, *Lamium purpureum*, *Matricaria spp*, *Setaria spp*, *Sinapis arvensis*, *Solanum nigrum*, *Stellaria media* were provided to train Convolutional Neural Networks (CNNs), for 30.000 epochs. The training images consisted of plant material from only one species, yet the recognition capabilities of the trained networks were tested also in typically mixed images deriving from a cultivated farm, with promising results.

Keywords: *Computer vision, Convolutional Neural Networks, DACWEED, Maize, Weed mapping.*

COMPARATIVE STUDY ON BIOCONTROL POTENTIAL OF LOCAL ISOLATES WITH COMMERCIAL FORMULATIONS OF *TRICHODERMA HARZIANUM* FOR MANAGING COLLAR ROT (*SCLEROTIUM ROLFSII* SACC.) OF CHICKPEA

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Abstract

Collar rot disease is a major constraint in chickpea production. Comparative efficacy of local isolates and commercial formulations of *Trichoderma harzianum* were evaluated in lab and field against collar rot of chickpea caused by *Sclerotium rolfsii* during 2018-2019. Tested local isolates and commercial formulations significantly inhibited mycelial growth of *S. rolfsii* *in-vitro* were evaluated in field condition as seed treatment @8gm/kg seed (cfu 1x10⁸/gm) & soil treatment @ 5kg/ha (cfu 1x10⁸/gm) with 100kg vermicompost prior to sowing and recorded the germination percentage, shoot length, root length, nodulation/plant, disease incidence and yield/ha. Maximum seed germination (88%), nodulation (44/plant), pod (306/plant) and highest yield (21.66 q/h) were recorded in soil treated with local *T. harzianum* isolate CRC, while, minimum seed germination (77.33%), nodulation (20/plant) in seed treated with *T. harzianum* (Bioharz) and lowest yield (15.83q/h) was observed in soil treated with *T. harzianum* (Bioharz). Maximum shoot length (55.33cm) & root length (24.33cm) was observed in seed treated with local *T. harzianum* isolate CRC and minimum shoot length (37.33cm) & root length (13.33cm) seed treated with local *T. harzianum* isolate KVK Hastinapur. Minimum disease incidence (3.57%) was found in soil treated with *T. harzianum* isolate CRC multiplied in vermicompost and maximum disease incidence (11.85%) was in soil treated with *T. harzianum* commercial formulation (Bioharz). However, local isolates as well as commercial formulation of *T. harzianum* decreased disease incidence and increased pod yield comparison to control.

Key words: *Sclerotium rolfsii*, *Trichoderma harzianum*, Chickpea, Collar rot disease and Vermicompost.

OPTIMIZATION OF CHANGES ON PROTEIN OXIDATION LEVELS, PHYSICAL AND FUNCTIONAL PROPERTIES OF SOY PRESS CAKE AND COCONUT PRESS CAKE, THROUGH ENZYMATIC HYDROLYSATE

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Abstract

Press cakes (by-product of cold press liquid extraction, applied as animal feed) could be applied as the ingredient of meat analogues, besides the reduction of the waste during food processing. Soy and coconut press cakes appear to be the cheap alternative sources for protein in the soy and coconut growing countries, which were investigated in the current research. Chemical and amino acids compositions of samples were analysed. The investigated press cakes were then enzymatically hydrolysed through the application of xylanase and α amylase enzymes. The effects of applied processes on protein oxidation levels, functional properties and physical characteristics of soy and coconut press cakes were evaluated and their relations were discussed, as in recent years an interest in protein oxidation has arisen, and food researchers and industries wear gradually realising the effect it might have had on food quality. The results indicated that soy and coconut press cakes wear suitable sources of protein, fiber, energy with low saturated fatty acids, and most essential and conditional amino acids. The research demonstrated the overall potential of enzymatic hydrolysate, as functional properties improver and protein oxidation reducer of soy and coconut press cake samples. However, physical properties of the investigated samples were generally decreased after the applied treatments. The results recommended those press cakes (mainly soy press cake) for further application of the meat analogues ingredients. Likewise, concerning optimization of applied processes effecting functional properties and protein oxidation stress, xylanase enzyme is highly recommended for enzymatic hydrolysate of soy press cake.

Keywords: *Enzymatic treatment, Press cakes, Protein oxidation, Functional properties.*

Acknowledgment: This research was a part of project, “Disaggregation of Conventional Vegetable Press Cakes by Novel Techniques to Receive New Products and to Increase the Yield” (DISCOVERY) H2020 activity ERA-NET SUSFOOD2. Research was funded by LR Ministry of Agriculture TM-18 1 / 2.

ASSESSMENT OF THE INSECTICIDAL AND REPELLENT EFFECT OF *CITRUS BERGAMIA* AND *ALLIUM SATIVUM* ESSENTIAL OILS IN CONTROL OF *TRIBOLIUM CONFUSUM*

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Abstract

Tribolium confusum Du Val. (confused flour beetle) is an important storage pest that is very common in warehouses, silos, attics, or storehouses. This pest reduces the quality, market value, yield of grains, cereals, pasta, spices, nuts and other products by feeding or contaminating products by leaving excrement, shell, and dead bodies. This research was aimed to assess the insecticidal and repellent effect of bergamot and garlic essential oils solution on *T. confusum*. Essential oils were applied in three different concentrations (0.5%, 1%, 2%) in contact and contact-digestive test. For estimating repellent activity, the Y-tube olfactometer was used with two different solution concentrations (1% and 2%). The experiment was performed in four replications at a temperature of $25\pm 1^{\circ}\text{C}$ and 45–70% RH, with 10 insects in each. The effects were determined after 24, 48 and 72h of application. The highest efficacy (100%) was accomplished only after 24h with a concentration of 2% for bergamot, in a contact test. In the same test with garlic, the highest value was 60% after 72h of exposure. For the contact-digestive test, the highest efficacy for bergamot was 97.5% after 48h and 52.5% for garlic with the dose rate of 2% after 72h. It was established that bergamot essential oil solutions (1% and 2%) showed repellent activity, as well as garlic in the concentration of 2%, while a concentration of 1% manifested neutral activity. For comparison, it can be concluded that bergamot had a better effect against *T. confusum*, than garlic.

Keyword: bergamot, garlic, *T. confusum*, biological protection, essential oil.

DISSIPATION RATE OF BOSCALID AND PYRACLOSTROBIN FUNGICIDE IN STRAWBERRY AND RASPBERRY FRUITS

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Abstract

This study was conducted in order to obtain the half-life of boscalid and pyraclostrobin fungicides in strawberry and raspberry fruits and to evaluate pre-harvest interval (PHI). The field trials were carried out in 2019 at two sites, located in Republic of Serbia. Strawberries and raspberries were sprayed with the commercial formulation (267 g a.i./kg boscalid and 67 g a.i./kg pyraclostrobin) in an application rate of 1.5 kg/ha. The samples of mature fruits were randomly collected after drying deposit and each day for one week. The extraction was performed using a QuEChERS based method, while for the simultaneous determination of boscalid and pyraclostrobin residues in strawberry and raspberry fruits HPLC/DAD was used. The method was developed and validated in accordance with SANTE/11813/2017 and applied on the real samples. The highest content of boscalid and pyraclostrobin residues in strawberry (10.23 mg/kg and 4.23 mg/kg) and raspberry (10.6 mg/kg and 7.63 mg/kg) fruits were immediately after drying the deposit. The residues of boscalid and pyraclostrobin in strawberry fruits, at the MRL level of 6 mg/kg and 1.5 mg/kg, respectively, were reached between 3rd-4th and the 4th-5th day after treatment and the residues in raspberry fruits, reached the MRL level (10 mg/kg for boscalid and 3 mg/kg for pyraclostrobin) at first and fourth day after the application. The results suggested that the boscalid and pyraclostrobin dissipation curves followed the first-order kinetic and their half-lives were 3.89 and 2.40 days in strawberries, and 4.1 and 2.77 days in raspberries. At the end of PHI (seven days), residues of both fungicides in strawberry and raspberry fruits were far below the MRLs.

Keywords: *boscalid, pyraclostrobin, strawberry, raspberry, dissipation.*

MICROBIAL DETOXIFICATION OF AFLATOXINS IN FOOD AND FEEDS: ADVANCES IN MOLECULAR AND BIO-ANALYTICAL APPROACH

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Abstract

Mycotoxins are secondary metabolites produced by a variety of toxigenic strains of fungi. These fungal metabolites are considered potent poisons that infect and contaminate agricultural commodities during storage, transportation, pre-harvest and or post-harvest stages. The contamination of crops by aflatoxins poses significant health risks for humans and animals that consume infected crops as mycotoxins have the ability to interfere with numerous pathways and processes. Microbial detoxification and biocontrol strategies are of importance for aflatoxin mitigation. Compost and soil samples were collected from Sharpeville, Vereeniging and Vanderbijlpark farms in South Africa. Isolation, identification, screening and purification of bacterial isolates actinomycetes, lactic acid bacteria and *Bacillus* species were performed to molecular level based on 16s rRNA next generation sequencing. Bacterial isolates and their ability in degrading AFB1 and its derivative AFM1 was investigated. Quantification of aflatoxins using bio-analytical tools TLC, HPLC, LC-MS/MS was performed. Novel microorganisms that degraded aflatoxin B1 and aflatoxin M1 to less toxic intermediates or end products were isolated, purified and identified. The aflatoxin degradation optimum condition (temperature, pH, incubation time) for each of bacterial strain was discovered. Our findings were novel and could possibly be employed in alleviation of food and feeds insecurities in sub-Saharan Africa and developing countries through aflatoxins mitigation using microorganisms.

Key words: *Mycotoxins, biocontrol, detoxification, LC-MS/MS, sequencing.*

THE CHANGES OF INSECTICIDES DURING FERMENTATION PROCESSES

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Abstract

Pesticide use is incontrovertible part of agricultural production, but their residues remain on food commodities during post-harvest period causes serious health and trade problems. Scientific data revealed that some food handling, preparation and processing methods affected the amounts of pesticide residues. Fermentation is a microbiological food preservation process catalysed by the enzymes of yeasts, bacteria, and moulds, that transforms carbohydrates into simpler components such as alcohols, acids, and gases. Changes of pesticide levels and transformation to other degradation products during fermentation could be a result of chemical or biological degradation. Biodegradation by microorganisms is an important way for the breakdown of many pesticides. Microorganisms can metabolize some pesticides as carbon and energy sources and can also break them down with their extracellular enzymes. These microbial mechanisms are affected by factors such as pH, moisture, temperature and light. pH degrees lower than 4 are desirable for the microbiological safety of the many fermented products. Experiments showed that some lactic acid bacteria and yeasts were able to degrade chlorpyrifos and deltamethrin (invitro) by their esterase enzymes and could utilize them as carbon and energy sources. It was also observed that levels of dimethoate, deltamethrin, imidacloprid, malathion, chlorpyrifos-methyl and lambda-cyhalothrin were affected by the pH values and microbial diversity of the different fermentation conditions. Declines in microbial growth and pesticide degradation rates were detected at lower pH (≤ 4) values.

Keywords: *biodegradation, bacteria, yeasts, food safety, residue.*

APPLICATION OF UNMANNED AERIAL VEHICLE TECHNOLOGY IN PLANT DISEASES DETECTION

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Abstract

The application of unmanned aerial vehicles (UAV) in corporation with remote sensing technology is a very promising branch of technology nowadays, and it offers the potential to collect detailed spatial information in real time at relatively low cost. UAV with remote sensing (RS) data have been frequently cited as a rapid, safe, non-destructive, and cost-effective tool for plant disease detection in different contexts and in different types of plant species. UAV technology has been used in agriculture with image processing technologies for variable purposes including; detection, monitoring, and identification of weeds and plant diseases, estimating the expected yield of agricultural products in their various stages of development. Accurate estimates of disease symptoms, the level of disease severity, and the negative effects of diseases on the quality and quantity of agricultural products are important for field crops, horticulture, plant breeding, and for improving the efficiency of fungicide, herbicide, and insecticide, as well as for basic and applied plant research. Since pest control usually consists of taking decisions based on; the level of infestation, the development stage of the plant, timely assessments of plant disease occurrence and disease spread, In this study; studies in crop disease detection with unmanned aerial vehicles technology and remote sensing as a challenging area that can have significant economic and environmental impact on crop disease management were provided, traditional disease detection methods were discussed, comparison between the traditional methods that used for crop disease detection and unmanned aerial vehicles remote sensing based methods, limitations faced by unmanned aerial vehicles technology, overview of current sensor technologies used for the automated detection and identification of plant diseases, and the benefits obtained as a result of using these new technologies were discussed.

Keywords: *Remote sensing; UAV; Disease detection; sensor.*

IMMUNOLOGICAL ASSESSMENT OF PROMISING WHEAT GENOTYPES TO MAJOR DISEASES SPREAD IN GEORGIA

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Abstract

Cereal production is deserve considered to be the basis for food safety. Wheat presents the staple crop for Georgians. Nowadays, average yield of wheat is 2,2 t/ha. Therefore, increasing the grain production by improving high-yielding competitive cultivars is one of the priorities for the agricultural sector of Georgia. In recent years, the situation has been improved through international collaboration with CIMMYT Winter Wheat Improvement Program. The presented research conducted within project #FR-18-978 also aims to identify improved genotypes that will be superior to the current commercial varieties in Georgia in terms of adaptation, disease resistance and yield through immunological and ecological testing in various agro-climatic conditions. Trials for assessment of the genotype reaction for major wheat diseases (stem rust, stripe rust, leaf rust, septoria glume blotch, tan spot) spread in Georgia were established over the first year (2019) of the project under the artificial infection both in the field and in the greenhouse conditions. International adopted methods were used for immunological assessment. 14 wheat accessions: Burbot-6; HBK0935W-24; SG-RU24; PYN/PARUS/3/L, DULGER-1/VORONA/BAU, FL9547/TX00D1626, KUV/LJILN//ORACLE;F885K1.1/SXL; WRM/4/FN;Amsel/TUI//LG-44,T08/02, T08/04, T03/017and KR11-9014 were earlier selected from different nurseries developed by ICARDA/CIMMYT breeding programs for this study. As a research result, seedlings and adult plants of five genotypes (HBK0935W-24; KUV/LJILN//ORACLE;T08/02, T03/017, PYN/PARUS/3/L) showed the complex resistance to all diseases. Their yield components will be studied in different locations of Georgia in the next two years.

Keywords: *Wheat variety, Rust resistance, Yield, Georgia.*

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3. ORGANIC AGRICULTURE

SOCIO-ECONOMIC AND BEHAVIORAL ASPECTS OF SLUDGE UTILIZATION IN BULGARIAN FARMS

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Abstract

The issue of sludge governance received from the wastewater treatment plants (WWTP) is extremely relevant and indisputably one of those discussed not only in Bulgaria, but also around the world. The positive role of sludge on the balance of humus as a result of activating the activity of soil microorganisms has also been proven. The aim of this article is to analyze the socio-economic and behavioral aspects of sludge utilization on farms. Extensive in-depth interviews have been conducted and summarized with farmers using and not using sludge in the Sofia region, aiming to gather complete information of production, economic, behavioral, organizational and other nature from farmers using and not using sludge. The main (economic, technological, behavioral, etc.) factors that influence the decisions on the use and non-use of sludge in agricultural production are identified. The results show that the effect of sludge utilization on crop yield is not instantaneous. It is established that there is a lag in revealing the benefits of this activity. Interviews conducted with farmers using sludge in their agricultural activities show twice the yields compared to conventional production. However, the application of sludge is accompanied by a number of challenges: public opinion, properties of sludge, as well as many issues related to the technological introduction of sludge in arable agricultural land.

Keywords: *agriculture, governance, sewage sludge, socio-economic aspects, Bulgaria.*

EFFECTS OF FERTILIZATION LEVELS OF POULTRY MANURE AND CUTTING TIMES ON *MORINGA OLEIFERA* PRODUCTION

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Abstract

The effect of different fertilization levels of poultry manure and cutting times were evaluated on the growth of *Moringa oleifera* Lam in western Cameroon from 2017 to 2018. *Moringa oleifera* seeds originating from Northern Cameroon were soaked for 12 hours in cold water and sown on plots of 3 m² made on a clay texture soil. A factorial design comparing six levels of poultry manure (0, 50, 100, 150, 200 and 250 kg N/ha) and three cutting times (4, 6 and 8 months) in four replicates was used. One month after sowing, fertilization was done. At each cutting time, 20 plants were collected per treatment for height and diameter measurements. Stem, leaf and whole plant of *M. oleifera* biomass were assessed on each plot based on the level of fertilization of poultry manure and cutting times. The results showed that irrespective of the cutting time, the highest plant height and diameter were obtained with 200 kg N/ha (160.37 cm and 2.37 cm respectively). The biomass of stems, leaves and the entire plant increased with the level of nitrogen fertilization. The best biomass was obtained at 6 months of cutting and with 200 kg N/ha (1.51, 0.90 and 2.41 t MS/ha respectively for leaves, stems and whole plant). This study concludes that vegetative growth of *Moringa oleifera* were best supported by 200 kgN/ha which is statistically significant as compared to other treatments.

Key words: Fertilization, *M. oleifera*, cutting times, height, diameter and biomass.

EFFICIENCY IN UTILIZATION OF PHOSPHORUS FOR SYMBIOTIC NITROGEN FIXATION AFFECTS THE PHOSPHORUS BIO-AVAILABILITY IN ORGANIC-HORTICULTURE SOILS OF HÉRAULT VALLEY

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Abstract

Phosphorus is one of the most limiting nutrients for plant growth in soil. Current study field experiments of Multilocation tests were carried out in various fields of production in the Hérault valley (France). Two contrasting RILs of common bean 115 and 147 were used through three seasons during the years of 2007-2009. The final objective would be to get a variety that combines good adaptation to production constraints, an appropriate yield and grain quality. Both are associated with rhizobial symbiosis for optimal nitrogen nutrition, and the efficient use of phosphorus to increase the soil fertility, save mineral fertilizer, minimizing environmental risk. The parameters which we investigated were shoots and nodules dry weight, number of nodules, contents of nodule and plant P and plant N, soil total and Olsen P, calcium carbonate and soil pH. In many sites inhibition of nodulation was found to be associated with an excess of N mineralization from organic fertilization. Among other sites correlations between shoot and nodules dry weight were significant within some individual sites. The influence of phosphorus on nodulation and growth could be established in the fields where the RIL115, tolerant to P deficiency, produced significantly more biomass than the sensitive RIL147. Thus during the year of 2007 and 2009, significant correlations between plant growth and Olsen P were observed. It is concluded that the RILs can be used to assess the adaptation of grain legume to low both N and P in soils, to identify soils where P availability is deficient for the legume N₂-dependent growth, and to improve the varieties of common bean for adaptation to low P.

Key words: *N₂ fixation, Phaseolus vulgaris, Phosphorus, Rhizobial symbiosis, Soil fertility, P acquisition and P utilization.*

YIELD STABILITY EVALUATION OF FOUR WINTER CEREALS IN CONVENTIONAL AND ORGANIC FARMING SYSTEMS

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Abstract

Winter cereals are cultivated over one third of Greek farmlands and are used for both feed and food. Their adaptability to varying environments and tolerance to dry conditions enables the utilization of semi-arid and arid areas to obtain agricultural products. The objective of the experiment was to evaluate the stability performance of five varieties for each of four winter cereals in order to determine the best matches for maximum yield in conventional and organic farming systems. The experimental work was conducted at the farm of Western Macedonia University of Applied Sciences in Florina, Greece, under organic and conventional production for two years. Four experimental fields, each for four species, were divided in two equal parts, one for conventional and one for organic farming system. Five varieties per species were used as follows: a) common wheat (*Triticum aestivum*) (cv. Acheloos, Irnerio, Vergina, Yecora, Yenerozo), b) durum wheat (*Triticum durum*) (cv. Athos, Bob, Simeto, Mexikali 81, Fenix), c) barley (*Hordeum vulgare*) (cv. Thessaloniki, Cannon, Konstantinos, Zotis A, Zotis), and d) triticale (\times *Triticosecale*) (cv. Vrito, Niobi, Vrodi, Catria, Ariti). The cultivation took place in a strip-plot design, with the five varieties randomized within each plot. Stability estimations were based on stability index $(\bar{x}/s)^2$, where \bar{x} and s were the entry mean yield and standard deviation, respectively. Generally, there were differences in yield stability across species and triticale showed the greatest values, followed by durum wheat. Barley showed the lowest stability index, since yields obtained by organic farming were significantly lower for all varieties in comparison to conventional farming. Results indicate that triticale exhibits a more balanced and stable performance, in both farming systems.

Key words: *cereals, varieties, organic farming, conventional farming, yield stability.*

ASSESSING YIELD STABILITY OF SIX COMMON VETCH (*VICIA SATIVA* L.) VARIETIES IN COMPARATIVE STUDY OF CONVENTIONAL AND ORGANIC FARMING SYSTEMS

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Abstract

Forage legumes are of great importance for their abilities to adapt in diverse environments, including the Mediterranean areas, where they are mainly grown for hay or silage production. They can fix nitrogen from the air, thus enabling sustainable and low input production. Common vetch (*Vicia sativa* L.) is native in the Mediterranean and is able to adapt in varying conditions and presents an important component for Greek agricultural systems. However, varieties need to be evaluated in order to achieve high productivity in different farming systems, i.e. organic or low input. The aim of this two-year study was the assessment of yield stability of common vetch varieties in both conventional and organic farming systems. Therefore, a field experiment was carried out in the farm of Western Macedonia University of Applied Sciences in Florina, Greece, regarding six varieties of common vetch (*Vicia sativa* L.), varieties, namely cv. Filippos, cv. Omiros, cv. Alexandros, cv. Tempi, cv. Zefyros, and cv. Pigasos. They were compared in a strip-plot design, with four replications and six varieties were randomized within each plot (the farming systems was one factor and variety the second factor). Plot size was 8.75 m². Stability estimations were based on stability index $(\bar{x}/s)^2$, where \bar{x} and s were the entry mean yield and standard deviation, respectively. Mean yield was estimated for each variety and farming system. Stability index (a specific ratio of mean and standard deviation) was used to depict which varieties were more stable across farming with varying inputs. The highest stability index was exhibited by cv. Filippos, while cv. Pigasos showed the lowest index value. However there were no detected great differences in stability performance among varieties.

Key words: *legumes, varieties, organic farming, conventional farming, stability.*

YIELD STABILITY OF FEED PEA VARIETIES IN VARYING FARMING SYSTEMS

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Abstract

Forage legumes are mainly grown for hay or silage production and are important crops for many Mediterranean agricultural systems. Feed pea (*Pisum sativum* L.) is a winter legume crop that could bring self-sufficiency in the livestock sector of the country and revenue in the domestic economy, completely replacing soybean in animal feed, which is imported and expensive to livestock producers. Growers have to choose from several native improved varieties, which are adapted to soil and climatic conditions of the country. The effect of the cultivation system and varieties of feed pea in the yield stability was assessed in a field experiment set up in the farm of Western Macedonia University of Applied Sciences in Florina, Greece for two years. Stability index contains a useful criterion for cultivar recommendation. The aim was the assessment of yield stability, in both conventional and organic farming systems. Five feed pea (*Pisum sativum* L.) varieties were used, namely cv. Olympos, cv. Pisso, cv. Livioletta, cv. Vermio and cv. Dodoni, in a strip-plot design, with four replications and six varieties were randomized within each plot (the farming systems was one factor and variety was the second factor). Stability estimations were based on stability index $(\bar{x}/s)^2$, where \bar{x} and s were the entry mean yield and standard deviation, respectively. Generally, there were differences in yield stability across farming systems and some varieties showed stable performance in both organic and conventional cultivation. The greatest values were exhibited by cv. Vermio, while cv. Dodoni showed the lowest values, followed by Livioletta.

Key words: *legumes, varieties, organic farming, conventional farming, yield stability.*

ISSUES ASSOCIATED WITH ORGANIC FARMING TO OVERCOME FOOD CRISIS IN KERALA STATE IN INDIA

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Abstract

The green revolution that helped India to overcome food crisis led to large-scale degradation of land and water resources. India is in the path of intense agricultural development to feed the fast rising population. Promotion of organic farming can contribute to the attempts in controlling the rising temperature. However, the small and marginal farmers face a number of challenges including the availability of ideal land, finance, proper insurance, good market and competition with the large firms. Organic farming is important as problems related to climate change are linked to fossil fertilizers. Loss of soil carbon can be solved through the improvements in farming systems and use of organic material. This paper highlights the importance of organic farming in the tropical state of Kerala under a changing climate and environment and rising food demands. In Kerala, demands in food are rising with growing population, whereas availability of reliable water and farm land are decreasing fast. The state with heavy rainfall and fertile soil depends on neighbouring states for rice and vegetables. More than 50% of the farmlands and irrigation canals were lost in the last few decades. Conservation agriculture becomes highly significant to maintain food security in the state. An assessment of the impact of climate change, environmental degradation and socio-economic issues on agriculture and of the current scenario of organic farming in Kerala has been made. Existing policies and management practices have been critically reviewed. Suggestions for an appropriate strategy and policy for organic agriculture have been provided.

Key words: organic farming, India, agriculture.

USE OF VERMICOMPOST IN ORGANIC AGRICULTURE

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Abstract

Vermicompost is the product of the composting process using various species of worms, usually red wigglers, white worms, and other earthworms, to create a mixture of decomposing vegetable or food waste, bedding materials, and vermicast. Vermicast (also called worm castings, worm humus, worm manure, or worm feces) is the end-product of the breakdown of organic matter by earthworms. These castings have been shown to contain reduced levels of contaminants and a higher saturation of nutrients than the organic materials before vermicomposting. Vermicompost contains water-soluble nutrients and is an excellent, nutrient-rich organic fertilizer and soil conditioner. It is used in farming and small scale sustainable, organic farming. Vermicomposting can also be applied for treatment of sewage sludge. A variation of the process is vermifiltration (or vermidigestion) which is used to remove organic matter, pathogens and oxygen demand from wastewater or directly from blackwater of flush toilets. Vermicomposting has gained popularity in both industrial and domestic settings because, as compared with conventional composting, it provides a way to treat organic wastes more quickly. The worms instinctively burrow to the bottom of the pile. After a few minutes, the top of the pyramid is removed, until the worms are again visible. This repeats until the mound is composed mostly of worms. While harvesting, also a good idea to try to pick out as many eggs/cocoons as possible and return them to the bin. Eggs are small, lemon-shaped yellowish objects that can usually be seen pretty easily with the naked eye and picked out.

Keywords: *Vermicompost, vermicast, sustainable, vermifiltration and cocoons.*

THE EFFECT OF ADDING ORGANIC MATTER AND PHOSPHATE FERTILIZER ON THE ABSORPTION OF NUTRIENTS IN CULIFLOWER

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Abstract

A field experiment was conducted at Al-Raid research station/ Ministry of Water Resources, in Abu Ghraib area for the 2009-2010 season, within the Abu Ghraib area for the 2009-2010 season in silt clay loam texture soil classified to sub under great group *Typic Torriflovent*. Randomly complete Block Design (RCBD) with three replications to study the effect of irrigation water quality, organic matter and level Phosphate fertilizer added in the absorption of nutrients by the plant. The experiment included three variables: irrigation with three qualities for irrigation water with different electrical conductivity 1.4, 3.0 and 4.5 dS m⁻¹ and two levels of organic fertilizer (sheep residue) zero and 20 Mg ha⁻¹. And three levels of phosphate fertilizer (DAP 21% P) 0, 45 and 90 kg P ha⁻¹. Plant samples were taken in the flowering, and ripening phases to estimate the content of absorbed nutrients (N, P and K) during the ripening stage. The most important results obtained can be summarized as follows: (i) The increase in the salinity of irrigation water led to a significant decrease in the absorbed amount of nitrogen Phosphorus and potassium (ii) the addition of organic waste to the soil reduced the harmful effect of salinity of irrigation water and significantly increased the absorbed amount of nitrogen, phosphorous and potassium, (iii) the addition of phosphate fertilizer resulted in a significant increase in the absorbed amount of nitrogen, phosphorous and potassium.

Keywords: *Randomly complete Block Design, phosphate fertilizer (DAP).*

THE PROSPECTS FOR USING THE BIOSTIMULANT REGLALG TO ACHIEVE ORGANIC PRODUCTION IN CONDITIONS OF DROUGHT AND EXCESSIVE TEMPERATURES

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Abstract

Contemporary agriculture faces several problems associated with the necessities to obtain a harvest that meets the requirements of organic farming aggravated by the increased risk of global warming. The reduction, or even the total exclusion of the use of synthetic substances for plant protection, can be solved due to the use of biostimulators, obtained by extracting active components from different plant sources. Using the methods of systemic approximation, the biostimulator *Reglalg* has been developed by extracting from the biomass of algae sp. *Spirogyra*. Treatment of seeds before sowing and plants on vegetation stimulates the development of the root system, improves the plants' vitality and quality of the crops by natural mechanisms. It induces the systemic acquired resistance; plants become more adaptable to stress conditions. In mixture with fungicides and pesticides, *Reglalg* diminishes their effective doses, reduce losses, and increases harvest. It is an option for economically sustainable organic crop production. *Reglalg* has a broad spectrum of applications: cereals, maize, sunflowers, potatoes, vegetables, grapevine, and fruit trees. To cereal plants, it promotes deeper immersing in the soil of the node of business that protects plants from frost and drought. Initial relative delay of shoots growth due to treating seeds with the solution of *Reglalg* is accompanied by stimulation of their growth and development during the vegetation period.

Keywords: *Biostimulator Reglalg, Organic agriculture, Abiotic stresses.*

EFFECTS OF GREEN FERTILIZERS ON THE QUALITY STATUS AND PRODUCTION CAPACITY OF THE CAMBIC CHERNOZEM FROM MOLDOVA

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Abstract

Chernozems Cambic from Central Moldova are subject to different forms of anthropogenic degradation. One of these is dehumification (loss of humus) and compaction of arable soil layers. In the recent situation regarding soil degradation of Moldova, the use of green fertilizers (leguminous) in crop rotation is the only possibility to remediate and maintain the quality status of the arable soils for the long term. Research was carried out over two farming years (2015-2016). In order to assess the quality status and production capacity of degraded cambic chernozems, two green mass harvest of vetch were incorporated into the soil as organic fertilizer on the field used for one year as an "busy field" - sown with vetch two time (autumn 2014 and spring 2015), in the 5-field crop rotation (vetch-wheat-rapeseed-barley-sunflower). The research results showed that the incorporation into the soil by disking two harvests of green mass and vegetal debris of vetch (about 12,4 t ha⁻¹) as organic fertilizers led to the increase of humus content by 0.20%, compared to the control variant; to accumulation in the soil of 310 kg of nitrogen, of which 180 kg fixed from the atmosphere; synthesis of about 3 t ha⁻¹ of humus or 1.7 t ha⁻¹ of carbon; sequestration of about 6.3 t ha⁻¹ of CO₂; a weakly positive balance of organic matter and nitrogen in the soil over 3-4 years was insured. On the plot where one harvest of green mass of vetch was incorporated into the soil as green fertilizers, the increase in the wheat harvest increased up 2.4 t ha⁻¹, and on the plot where two harvests of green mass of vetch were introduced into the soil, the harvest increase up 3.2 t ha⁻¹, the total harvest was 7.0 t ha⁻¹.

Key words: *Chernozem Cambic, Degradation, Organic matter, Green mass of vetch.*

BIO-FERTILIZERS FROM OLIVE MILL WASTEWATER AND PHOSPHATE RESIDUES APPLIED ON TOMATO: TARGETING CIRCULAR ECONOMY CONCEPT

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Abstract

Tomato *Solanum lycopersicum* plants were grown under greenhouse located on a research platform in Murcia (Spain). Tomatoes plant were fed with bio-fertilizers issued from anaerobic digestion of olive mill wastewater (OMW) and phosphate residues (PR) under mesophilic conditions for 25 days in batch reactors. 1% of Substrates (OMW+PR initial) and digestates (OMW+PR final) was provided fortnightly to the plants. Reclaimed water from the same wastewater treatment plant was used for automatic controlled irrigation. It contained low level of chemical fertilizers in order to compare tomato plant growth, leaf analysis, steam water potential, production yield and fruit quality results to plants fed with bio-fertilizers. Generally, parameters and results were positively increased during growing and harvesting stage, which refer to the presence of essential elements that cover plants need. Biofertilizers (digestates) showed good performances, high fruit quality and perfect tomato yield production in comparison to the plants control. This study presents a new pathway for scientist in this field. In addition, the results were confirmed with the statistical analysis using ANOVA test Tukey post-hoc.

Keywords: *Anaerobic digestion, biofertilizers, Olive mill wastewater, Phosphate residues, Reclaimed water.*

ORGANIC FERTILIZATION EFFECT ON HEMPPRODUCTION

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Abstract

The organic fertilization is getting popular and required. One of the possibilities of organic fertilizer is the mulberry silkworm (*Bombyx mori* L.) breeding waste. This insect breeding is a cheap source waste, which gives very positive results on the plants yield. In this research 3 repetition pots were tested: with silkworm fertilizer 15 t/ha, 30 t/ha and pots without fertilization (control). The total length, technical length, panicles length and diameter of hemp were measured. Moreover, the chemical composition of plants with and without fertilization was compared. The mean total length and technical length were highest in 15t/ha of manure dose. The panicles and the diameter of hemp were highest after 30 t/ha of manure dose.

Key words: mulberry silkworm, *Bombyx mori* L., waste management, *Cannabis sativa* L.

AROMATIC PLANTS IN WEED CONTROL: THE EFFECT OF PLANT AQUEOUS EXTRACTS ON GSH CONTENT IN BLACK NIGHTSHADE

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Abstract

In the context of green chemistry, there is an urgent need for development of natural compounds as an alternative method to the chemical control of pest. The objective of this study was to evaluate the effects of aqueous extracts of three wild-growing aromatic plants, *Clinopodium menthifolium* (Host), *Satureja montana* L. and *Salvia sclarea* L. on the black nightshade (*Solanum nigrum* L.), antioxidant properties to explore the potential of these aromatic plants in weed control. The experiment was performed at the Laboratory of Biochemistry, Faculty of Agriculture, Novi Sad and conducted under controlled conditions (28°C, 60% relative humidity, a photoperiod of 18 h, and a light intensity of 10.000 lx). The black nightshade (*Solanum nigrum* L.) seeds were placed in plastic pots containing sterile sand and maintained under dark conditions. Thirty-day-old seedlings were transplanted in plastic pots containing 700 mL of Hoagland's solution and 7 or 14 mL of 10% *C. menthifolium*, *S. Montana* and *S. sclarea* aqueous extract, separately, while pots of control contained the same volume of nutrient solution. The final concentration of the extract was 0.1 and 0.2%. The effect of two concentrations of *C. menthifolium*, *S. montana* and *S. sclarea* aqueous extract on the reduced glutathione content (GSH) in roots of black nightshade seedlings were examined 24 h, 72 h and 120 h after the treatment. The reduced glutathione content was determined spectrophotometrically according to Sedlak and Lindsay (1968). Our results showed that GSH content was higher in the roots of the treated black nightshade plants compared to plants from the control group 24 h after the treatment. On the other hand, 120 h after the treatment the GSH content was lower in the roots of treated black nightshade plants while lower values were in the treatments with higher concentrations (0.2%) which pointed out that tested aqueous extracts possessed a negative effects on the black nightshade antioxidant system.

Keywords: Antioxidant system, Aromatic plants, *Solanum nigrum* L.

ECOLOGICAL AND INTEGRATED CROPPING SYSTEMS IN SOUTH SLOVAKIA: RESULTS OF LONG-TERM EXPERIMENTS

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Abstract

The external inputs differ strongly between farming and cropping systems. In conventional systems high external inputs are used (synthetic fertilizers, chemical plant protection products). Contrary to that, external inputs are reduced or prohibited in organic (ecological) agriculture, used technologies promote and are based on ecosystem health. Literature evidence on the effect of cropping system on yield of crops is often contradictory, and reflects the differences in environmental conditions, agricultural practices, crops, selection of cultivars, etc. Six course arable ecological and integrated cropping systems were established in 1999 on Haplic Luvisol located in warm agro-climatic region, arid subregion with predominantly mild winter. The target for integrated system was improvement in the medium-term, the target for ecological system was improvement in the long-term. Within each system, fertilized and unfertilized variants were used. Within 16 years period, the average yields of spring barley, peas, maize (silage) and winter wheat grown after alfalfa did not differ significantly. Significant difference was determined in the yield of alfalfa, with increase by 2.5 t.ha⁻¹ in integrated system. Effect of fertilization was significant for all crops besides peas. Yield increase under fertilized treatments in winter wheat and maize (silage) was 10.4%, the highest increase on fertilized treatment was recorded in spring barley 18.1%, and the lowest effect was found for alfalfa 6.0%. Designing of site specific multifunctional crop rotation with well managed ecological plant nutrition and crop protection is crucial for long-term sustainability of the system.

Keywords: *Ecological, Integrated, Cropping systems, Yields, Slovakia.*

BIOPROSPECTION AND FUNGI CHARACTERIZATION FOR RUNOFF WATERS MYCOFILTRATION AND SOILS MYCORESTORATION

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Abstract

Agriculture and industry release important quantities of organic and inorganic chemical compounds and heavy metals, contaminating running water, underground water, soils and atmosphere. The decontamination of these different environments is expensive and often impossible. New decontamination techniques are needed such as mycoremediation. Saprophytic fungi, used in mycoremediation, secrete extracellular enzymes, such as lignine peroxydases, manganese peroxydases and laccases, which degrade aromatic and non aromatic hydrocarbons in smaller molecules, which are then absorbed by fungal hyphae and used to produce energy or metabolic compounds. They also can absorb heavy metals. Decontamination of fluids is called mycofiltration, while decontamination of soils and wastes is named mycorestoration. This last use is based on the propagation of mycelia in the soils to reach and degrade pollutants or assimilate heavy metals. The objectives of the present work were to identify and characterize new endemic fungi for mycoremediation in contaminated runoff waters and soils. Isolated and characterized fungi were then tested for their mycofiltration potential of an aircraft deicing product (polypropylene glycol, PPG), used at Geneva Airport. Around 400 fungi were isolated from two contaminated soils and two natural soils, yielding 271 phenotypes, with 50 isolates displaying one enzymatic activity, 35 isolates two enzymatic activities and 16 isolates three desired activities. All were genetically identified. The isolates with three enzymatic activities were tested to degrade PPG in the deicing agent. Some isolates showed a very promising activity of degradation of PPG. Testing will go on to remove pollutants in diverse environments.

Keywords: *fungi, mycoremediation, mycofiltration, mycorestoration, polypropylene glycol.*

PHYTOPATHOGENIC FUNGI AND OOMYCETES DETECTION WITH E-NOSE AND SPME-GCMS DEVICES

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Abstract

Pathogen identification is usually achieved through symptoms description, pure culture isolation, morphology and genetic characterization or immunological tests, which is time- and labour-consuming, expensive and not suitable for large-scale monitoring. Sometimes, symptoms are not visible, being underground or not specific, making diagnosis difficult. Many pathogenic fungi and oomycetes emit gender- or species-specific volatile organic compounds (VOCs). Therefore, electronic noses could allow a quick diagnosis and detection, even in absence of visible symptoms, applicable to field monitoring or legal control of importations. To improve e-nose performance, identification of pathogen-specific VOCs is the key issue for a better sensing efficiency. We analysed fungi and oomycetes of agricultural or silvicultural importance with an e-nose. The VOCs emitted were also investigated by SPME-GCMS. The tested species included eight fungal strains (*Armillaria gallica*, *A. ostoyae*, *Fusarium avenaceum*, *F. culmorum*, *F. oxysporum*, *F. poae*, *Rhizoctonia solani* and *Trichoderma asperellum*) along with four oomycetes species (*Phytophthora cactorum*, *P. cinnamomi*, *P. plurivora*, *P. ramorum*). *F. poae*, *R. solani* and *T. asperellum* induced a strong and immediate response from the e-nose. The other *Fusarium* species, and *P. ramorum* generated a less intense reaction, while *Armillaria* and remaining *Phytophthora* were very weak VOCs emitters. All fungi species (except *R. solani*) were producing sesquiterpenes, contrary to the oomycetes which did not emit any. Aliphatic hydrocarbons, alcohols, aldehydes, esters and benzene derivatives were spotted in all samples. The major difference in VOCs emission lied in sesquiterpene production, with fungi emitting some, while oomycetes releasing none or significantly smaller amounts.

Keywords: *electronic nose, Fusarium, Phytophthora, Rhizoctonia, SPME-GCMS.*

AGROFORESTRY SYSTEMS MAY IMPACT PESTS AND DISEASES IN ROBUSTA COFFEE IN ECUADORIAN AMAZONIA

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Abstract

We assessed how agroforestry and different types and levels of intensification affected pests and disease development on *Coffea canephora* (robusta coffee) trees in Joya de los Sachas, in the Ecuadorian Amazonia. Five coffee shading methods assessed were: 1) full sun; or *Musa paradisiaca* at 333 plants ha⁻¹ combined with 2) *Myroxylon balsamum*; 3) *Inga edulis*; 4) *Erythrina sp.* or 5) *Erythrina spp.* and *Myroxylon balsamum*. Four coffee farming practices assessed were: conventional farming at either 1) moderate or 2) intensified input or organic farming at 3) low or 4) intensified input. The experiment was a RCBD with 20 treatment combinations, replicated three times. Shade cover above coffee was assessed with a pyranometer. Infestation of pests and disease incidence were evaluated monthly for the brown twig beetle (*Xylosandrus morigerus*), the coffee leaf miner (*Leucoptera coffeella*), the coffee leaf borer (*Hypothenemus hampei*), the coffee berry disease (*Colletotrichum spp.*), the thread blight (*Pellicularia koleroga*) and cercospora leaf spot (*Cercospora coffeicola*). Furthermore, coffee berry disease severity was assessed with the help of Image J. Agroforestry with *Inga edulis* reduced brown twig beetle infestation by 9%, compared to full sun treatment. Both brown twig beetle and coffee leaf borer infestation were both reduced by 12% in the intensified organic treatment compared with the intensified conventional treatment. Coffee berry disease severity was only 3% greater within the intensified organic farming in comparison to the intensified conventional treatment. Both shade tree treatments and management strongly influence pest infestation levels and diseases incidence and should be considered as optimum management strategies for coffee cultivation.

Keywords: *disease, Ecuadorian Amazon region, pests, Robusta coffee, pyranometer.*

EFFECT OF VERMICOMPOST AND VERMIFOLIAR ON GROWTH AND RELATED CHARACTERISTICS OF PEAS (*PISUM SATIVUM*)

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Abstract

Recently, there is increase use of vermicompost worldwide, which is a product of a non-thermophilic biodegradation of organic materials through interactions between earthworms and microorganisms as plant growth media and soil amendments. Vermicompost processed commercially from food waste and paper were applied to 3.6m² filled plots, at 2.5 t ha⁻¹ to evaluate the effects on growth and yield of peas at Horticulture Research Institute . Vermicompost was incorporated into the top 10cm of soil whilst vermifoliar was drenched into the soil at dilution rate of 1:10. Treatments included sole vermicompost, equal combinations of vermicompost and vermifoliar, supplementary-chemical (6:15:17) NPK fertilizer based on chemical analyses to equalize the initial fertilizer rates of 600kg ha⁻¹. All four treatments were replicated three times, in a completely randomized block design. Equal combinations of vermicompost and vermifoliar increased pea growth and yield significantly ($p < 0.05$): including increases of up to 40% in number of pods per plant, 32% in seed (fruit) number and 30% in pod weight(g) of standard means. The treatment combination also resulted in supreme quality of fruits and a deep green color. Least yields were observed in plots that received sole application of vermifoliar and chemical fertilizers. These responses could be attributed to availability of nutrients throughout the growing season of the crop- as vermi- products are slow in releasing nutrients. Based on other laboratory research, the superior yields might have been achieved due to production of plant growth regulators by microorganisms during vermicomposting process.

Key words: *Vermicompost, vermifoliar, peas.*

CHEMICAL COMPOSITION AND ANTIOXIDANT ACTIVITY OF BLACKBERRY, BLACK CHOKEBERRY AND JOSTABERRY

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Abstract

There is a general belief that the brighter and more deeply colored fruits contain higher levels of antioxidants, minerals and vitamins. Three black-fruited bushes: blackberry (*Rubus fruticosus* 'Thornfree'), black chokeberry (*Aronia melanocarpa* 'Nero') and jostaberry (*Ribes x nidigrolaria* 'Josta') were grown under identical agro-ecological conditions, practicing organic farming without chemicals. The fruits of this species were analyzed for nutritional properties, essential elements, bioactive content and antioxidant potentials. Dry weight, total ash, acidity, total sugar and vitamin C were determined according to AOAC. Mineral elements (P, K, Ca, Mg, Fe, Mn, Zn, Cu, Na, Al, Se, Cd, Cr, Pb) were quantified by flame atomic absorption spectrometry. Total flavonoids were determined by Kumaran and the total flavonols by Ordonez method. Anthocyanins were quantified spectrophotometrically by modified single pH and pH differential method, described by Sun, Chu, Wu & Liu. Total phenolic content was determined using Folin-Ciocalteu reagent assay. Antioxidant activity of fruits has been evaluated by ABTS, DPPH and FRAP assays, in the manner described by Pellegrini *et al.*, Liyana-Pathiranana & Shahidi and Benzie & Strain, respectively. All three species have a fairly uniform elemental composition. Only black chokeberry has a significantly higher zinc content (2.07 mg/100 g). On the other hand, jostaberry stand out in acidity (2.4 %) and vitamin C concentration (78.3 mg/100 g). When it comes to phytochemicals, black chokeberry dominates superiorly in the content of anthocyanins (45.92 µg/mg), flavonols (0.77 mgQcE/g), flavonoids (71.42 mgQcE/g) and phenols (74.80 mg GAE/g). The same is with the antioxidant capacity for all three assays: 0.17 mg Trolox/mL (ABTS), 0.97 mg Trolox/mL (DPPH) and 0.10 mmol Fe (II)/mg F.W. (FRAP). The presented results affirm three black-fruited bushes as valuable and healthy fruit crops, interesting not only for commercial cultivation, but also for peri-urban farming and urban gardening.

Key words: *blackberry, black chokeberry, jostaberry, antioxidant properties, phytochemicals.*

SELECTION OF BIOACTIVATORS AND EVALUATION OF THEIR ROLE IN THE PRODUCTION OF COMPOSTS BASED ON BY-PRODUCTS FROM THE DAIRY AND WINE PRODUCTION CHAINS

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Abstract

Wine and dairy sectors represent two important production chains within Sicilian organic farming. From the environmental perspective, the by-products from these chains constitute a serious issue due to their difficult management. An alternative strategy to the disposal of wine and dairy by-products could be their reuse as raw materials for compost production allowing the recovery and valorisation of their organic content. In this study, three strains of cellulolytic bacteria belonging to the species *Bacillus subtilis*, *Bacillus velezensis* and *Kocuria rhizophila*, previously isolated from dairy and wine wastes, were used as bioactivators in order to accelerate and stabilize the composting process. The humidity of the heaps was maintained at 55% by wetting the mass with deproteinized whey (experimental composting) or water (control composting). From the analysis of the results obtained, the microbiological and physico-chemical parameters differed between water moistened piles and deproteinized whey sprayed piles. The bacterial strains inoculated in the different composts led to a decrease in the populations of total mesophilic microorganisms and filamentous fungi compared to the trials where organic matter degradation occurred spontaneously. Further studies will be carried out to clarify the role of the three bioactivators in view of their use in industrial compost production.

Keywords: *Compostage, Bioactivators, By-products, Cellulosolytic bacteria.*

PHOSPHATE-SOLUBILIZING BACTERIA ISOLATED FROM PHOSPHATE SOLID SLUDGE AND THEIR ABILITY TO SOLUBILIZE THREE PHOSPHATE FORMS

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Abstract

Biofertilizers are a key component of organic agriculture. They play a crucial role in soil fertility and sustainability. Bacterial biofertilizers can improve plant growth through different mechanisms, such as mobilization of soil compounds, phosphate solubilization bacteria (PSB) transform the insoluble phosphorus to available form for plants. This specificity of PSB allows them to be used as biofertilizers in order to increase the P availability which is an immobile element in the soil. The objective of our study is to assess the capacity of PSB strains isolated from solid phosphate muds to solubilize three forms of inorganic phosphates: tricalcium phosphate ($\text{Ca}_3(\text{PO}_4)_2$), aluminum phosphate (AlPO_4) and iron phosphate (FePO_4), in order to select efficient solubilization strains and use them as biofertilizer in any type of soils, either acidic or calcareous soil. Nine strains were tested for their ability to solubilize phosphate in the NBRIP medium with each form of phosphate ($\text{Ca}_3(\text{PO}_4)_2$, AlPO_4 and, FePO_4) as the sole source of phosphorus. The phosphate solubilizing activity was estimated by the vanadate-molybdate method. All the strains tested showed significantly ($p \leq 0.05$) the ability to solubilize the three different forms of phosphates, with a variation between strains, and all strains solubilized $\text{Ca}_3(\text{PO}_4)_2$ more than FePO_4 and AlPO_4 .

Keywords: *Phosphorus, Inorganic phosphate, Phosphate solubilization bacteria, bioavailable phosphorus.*

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COMPLEX ASSESSMENT OF BIOSOLID FOR AGRICULTURE USING LIVING ORGANISMS UNDER LABORATORY CONDITIONS

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Abstract

The use of biosolids (treated municipal sewage sludge) as a fertilizer is the best way of their disposal. However, not all of them are suitable for use as a fertilizer. Biosolids should be subject to mandatory laboratory control to confirm their safety. Two directions of research on biosolids are being improved: chemical and biological. Chemical analysis methods allow us to determine the qualitative composition of complex waste. The biological approach (use of living organisms) allows us to estimate the total toxicity of all the components. Accordingly, a distinctive characteristic of biological methods is the integrated approach. We examined biosolid extract using a wide range of bioassay methods. As test organisms, we took *Daphnia magna* Straus, *Paramecium caudatum* Ehrenberg, *Tetrahymena pyriformis*, luminescent bacteria *Escherichia coli*. In addition, a phytotest was carried out on the culture of *Avena sativa* L. and *Raphanus sativus* L. None of the tests revealed a high toxicity of biosolid. Biosolid safety was confirmed by a low content of potentially toxic water-soluble elements – ($\mu\text{g/l}$): Al^{3+} – 980; Ba^{2+} – 19; B – 140; Mn – 360; Cu – 61; As – 57; Ni – 200; Pb – 1,4; Sr^{2+} – 302; Cr – 18; Zn^{2+} – 310; Co – 30; Mo – 56; (mg/l): Na^+ – 16,8; Fe – 1,0. The bioassay methods make it possible to give an indicative safety assessment of this type of object by the effect of readily soluble (readily available) components from this object on living organisms and plants. The use of bioassay methods using soil extraction as a control tool allows to take into account the combined effect of the presence in the extraction of not only toxic elements that suppress the vital activity of organisms, but also of elements that attract and stimulate the activity of test-organisms.

Keywords: *bioassay, biosolid, sewage sludge, environmental safety, agriculture.*

**4. ENVIRONMENT PROTECTION
AND NATURAL RESOURCES
MANAGEMENT**

IS THE EXPLOITABLE BIOMASS (*B*) VULNERABLE TO CHANGES OF NATURAL MORTALITY (*M*) BY AGE? CASE OF *SARDINA PILCHARDUS* (WALBAUM, 1792)

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Valuing and preserving of small pelagic fish–REVIECO, Faculty of Science, University Algiers 1, Algeria

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Abstract

For this study, 3571 individuals of all sexes, with sizes ranging from 7.25 to 17.75 cm, were studied. Monthly sampling was conducted from December 2018 to March 2020 from landings of seiners operating in the central region of Algeria between Tenes and Bejaia. To feature a potential effect of changes in characteristic mortality (*M*) on the biomass level of *Sardina pilchardus*, it was important to estimate its value for the entire population at first and then for each age class. The VPA was then run with a constant estimation of *M* [0.6 yr⁻¹] and a variable one [from age 1 to 4 = 1.466; 0.818; 0.680; and 0.591 yr⁻¹]. The outcomes appeared for both constant and variable *M* a condition of "not overfishing and not overfished", with, for constant *M* a biomass estimation of 5636 tons and 6453 tons for variable *M*. The addition in biomass level estimation was around 13%, when the estimation of the yield per year stayed fundamentally the equivalent [around 2912 tons]. Finally, we recommend incorporating changes of natural mortality (*M*) in biomass estimation studies to get closer to reality. Indeed, at younger age small pelagic fishes are the most vulnerable classes to mortality caused by predation or pollution induced stress. This fact must be taken into serious consideration for a better monitoring of exploitable stocks, without ignoring the degree of uncertainty of estimates.

Keywords: *Sardina pilchardus*, Algeria, *M*, Biomass.

IS THE EXPLOITABLE BIOMASS (B) VULNERABLE TO CHANGES OF NATURAL MORTALITY (M) BY AGE? CASE OF THE ROUND SARDINELLA

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Valorisation and preservation of small pelagic exploitable stocks – REVIECO – Faculty of Science – University Algiers 1, Algeria

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Abstract

A proper estimation of biomass is critical for environmental and decision making to conserve fish stocks. This work aims to explore the vulnerability of biomass estimation to the variability of natural mortality M by age. 2460 individuals of all sexes, sizes ranging from 7.25 to 21.75 cm, were studied. Monthly sampling was conducted from December 2018 to March 2020 from landings of seiners in the central region of Algeria between Tenes and Bejaïa. Descriptive statistics were performed using FISAT II and VIT4Win. The results generated two different scenarios: first, the current total biomass (B_c) was estimated at 8686.6 tons for $M = \text{constant} = 0.51 \text{ yr}^{-1}$; secondly total biomass was estimated at $B_c = 10636.4$ tons for $M = \text{variable by age } n, M_n$, [$M_1 = 1.130$; $M_2 = 0.791$; $M_3 = 0.721$; $M_4 = 0.606$; $M_5 = 0.545 \text{ yr}^{-1}$]. Evaluating B_c with constant M showed a decrease of 1914.19 tons compared to biomass assessment with M_n . Judging by these results, considering that mortality M varies with age has a great impact on biomass evaluation. Naturally, juvenile fish are exposed to larger predation mortality than an adult fish. This difference in predation mortality may be quite significant. Finally, we recommend adjusting the catch effort factor $F_C = 1$ to $F_{0.1} = 0.54$ for M variable. This precautionary approach would permit long-term renewal of the stock of *S. aurita* in the central region of the Algerian coast (increasing sea biomass from 10632.91 to 14848.9 tons).

Keywords: *Sardinella aurita*, Algeria, Biomass (B), Mortality (M), Stock assessment.

VALORIZATION OF BY-PRODUCTS OF CITRUS FRUITS

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Abstract

This study is related to the extraction and the characterization of the pips of Tangerine citrus *reticulata*. The result of the physic-chemical characteristic allow the use of this oil in food and cosmetic industry (Saponification index=199). The determination of fatty acids profile revealed the prevalence of unsaturated fatty acids (65.59%) compared to the saturated fatty acids (22.03%). Index of non-saturation calculates is of 2.98% qualifying our unsaturated oil. This unsaturation is allotted to the linoleic acid (39.94%) and the oleic acid (25.65%). The saturated fatty acids more dominating were palmitic acid and with the content of 16.31%, the stearic acid accounting for 5.54% and the acid arachidic is 0.46%. The test of rancimat showed that our oil present a time of induction of 12.91 hours at 25°C and 12.5 hours at 15°C which is synonymous with easily oxydable oil.

Key words: *Citrus, valorization, by-products, oil, rancimat.*

PHYLOGENIC APPROACH AND BIO-ECOLOGICAL ASPECTS OF THE GENUS *BARBUS* (CYPRINIDAE) FROM ALGERIA

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Abstract

In Algeria, the genus *Barbus* is represented by 9 species; *B. setivimensis* b(Valenciennes, 1842), *B. biscarensis* (Boulenger, 1911), *Luciobarbus callensis* Syn. *Barbus callensis* (Valenciennes, 1842), *B. desertii* (Pellegrin, 1939), *B. figuigensis* (Pellegrin,1939), *B. amguidensis* (Pellegrin,1934), *B. nasus* (Günther,1874), *B. pallaryi* (Pellegrin,1924) and *B. antinorii* (Boulenger, 1911). *B. amguidensis* and *B. desertii* are endemic to the Sahara. The structure of the natural populations was achieved through the variability analysis according to the quantitative morphological characters. A molecular analysis was made to distinguish the species colonizing different biotopes. This investigation is a contribution to the knowledge of the size and mass growth model of this genus and an assessment of the environmental impact of the growth and physical conditions of the barbel populations in different aquatic ecosystems. The obtained growth model is almost linear and different from the classical von Bertalanffy curve. This may be explained by the severe local hydrological conditions that do not allow the survival of individuals beyond 5 years.

Keywords: *Barbus*, phylogeny, growth, von Bertalanffy patterns.

STUDY OF FRUIT TREES LEAFHOPPER

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Abstract

The present work is a study of the infestation state of fruit trees by leafhopper. Two regions have been investigated in the Wilaya (province) of Tlemcen (northwestern Algeria), which are: the El Fhoul region (El Azaïza village) and the Mansourah region. In both regions, leafhoppers have been detected on olive trees and are of the type: green leafhopper (*Empoasca vitis*) in El Fhoul, and a white or prickly leafhopper (*Metcalfa pruinosa*) in Mansourah. The rate of infestation is heterogeneous and varied, but the highest rate was marked in the El Fhoul region, with remarkable symptoms and damage. Our test results of treatment with Akito have shown that this insecticide remains ineffective and unsatisfactory. On the economic and ecological front, preventive control remains the most favorable and effective means. But our exploration in both regions has shown that lack of information among farmers and inefficiency of extension are the first obstacle to be overcome for the dissemination of these insects.

Keywords: *Leafhopper, Fruit tree, Olive tree, Wilaya of Tlemcen.*

EFFECT OF PHYTOSANITARY TREATMENTS ON THE CONTENT AND BIOLOGICAL ACTIVITY OF APPLE SECONDARY METABOLITES

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Abstract

The objective of this work is to study the effect of phytosanitary treatments intensities on the content and antimicrobial activity of a total polyphenols and flavonoid compounds extracted from *Golden delicious* apple peels cultivated in Algeria. Methanolic extracts of apple peels from two orchards were prepared and tested against some pathogenic strains. The highest yield of total polyphenol and flavonoids is obtained from the least treated orchard, while the antimicrobial activity of total polyphenols and flavonoids showed more remarkable antifungal activity than antibacterial activity.

Key words: *Apple, Golden delicious, polyphenols, Flavonoid, Antimicrobial activity*

THE DIFFERENT ASPECTS OF WATER SHORTAGE AND FOOD DEPENDENCE IN ALGERIA

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Abstract

Algeria is classified among the countries most deficient in water. Located in the geographic area of Middle East and North Africa (MENA), almost all of its territory (87%) is classified as a desert area. Its average annual rainfall, all areas combined, is only around 89 mm/year. As a result, Algeria is ranked among the 17 countries that suffer the most from lack of water worldwide. Indeed, with less than 300 m³/hab./year of renewable water, that is less than 5% of the world average estimated at 6000 m³/hab./year. Thus, Algeria has only less than 30% of the theoretical scarcity threshold set by the World Bank at 1000 m³/hab./year. This situation makes that agricultural production does not manage to cover the food needs of the population; therefore, Algeria is subject to an acute food dependence, particularly, in regards to strategic food products of great consumption, such as cereals and their derivatives. This dependence is the result of a number of natural and human factors that we develop in our study.

Keywords: *Lack of rains, water resources, food dependence, irrigation efficiency, virtual water, Algeria.*

FIRST INVENTORY OF APHID PARASITOIDS ASSOCIATED WITH APHIDS FEEDING ON POTATO CROPS IN AN ARID REGION OF ALGERIA AND THE CONSEQUENCES FOR THE MANAGEMENT OF PEST CONTROL

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Abstract

In Algeria, the potato (*Solanum tuberosum* L.) is considered as first production in the Algerian's diet compared to other vegetables. Potato producers are developing this culture in the Djelfa region (center of Algeria) characterized by a semi-arid to arid climate with high temperatures and low relative humidity (RH). In this region, potato crops are regularly attacked by various aphid species considered one of the major pests causing serious yield losses. *Aphis gossypii* Glover, *Macrosiphum euphorbiae* Thomas and *Myzus persicae* Sulzer were found to be the most important species among several species recorded during five seasons. In order to control their crops, farmers are influenced by the insecticide companies to use more insecticides. This study was carried out to evaluate the potential of the parasitoid complex associated with aphid fauna feeding on untreated potato plots to determine their incidence on the aphid populations. Sampling was made on 15 sites located in different zones during the spring from 2013 to 2017. Weekly, 03 leaves per plant were cut from infested plants on 50 plants par plot and put in a plastic bag. The samples were transferred to the laboratory where full mummies were taken and put in transparent capsules for determining the identity of emerged wasps. Only (4) four aphid parasitoid species were listed, showing a poor diversity compared to the parasitism richness in other parts of Algeria with two *Lysiphlebus* species (*L. testaceipes* (Cresson), *L. fabarum*(Marshall) and two *Aphidius* species (*A. matricariae* (Haliday) and *A. ervi* (Haliday) recorded with varying proportions according to site or year. These first results give an overview on the difficulties in valuing beneficial species in such climatic conditions, showing the importance of the ecological role of biodiversity in a new agro-ecosystem. We suspect the low specific diversity of Aphidiinae as the result of predation of some predators on parasitized aphids before their mummification in fields. We are trying to find how to integrate their action into a control program with the least amount of pesticides possible for their use within a program IPM.

Keywords: *Arid climate, Potato crop, Aphids, aphid parasitoids, intra- guild interactions, biodiversity.*

STUDY OF REPRODUCTIVE INDEX OF WILD BOARS (*SUS SCROFA*) IN CONTROLLED FARMING IN BOSNIA AND HERZEGOVINA

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Abstract

Wild boar (*Sus scrofa*) is an attractive game species that belongs to the genus *Sus* of the Suidae family of artiodactyl mammals. It is an omnivore that feeds on roots, bulbs, acorns and other fruits, rodents, etc. It is active in the afternoon and at night; it lives in herds that are during the time of mating joined by other old boars (which are solitary). Wild boar is a widespread species of wild animal. Its natural habitat is in Europe (excluding Scandinavia and the island countries), in Central and South Asia, North and South America, and in Australia. In Bosnia and Herzegovina, wild boar is a widespread game animal and for many reasons is increasingly being reared even in controlled farming. Training of hunting dogs and selling wild boar meat are common reasons for wild boar farming in our country as well as in the surrounding countries. Reproductive parameters are extremely important from the aspect of wild boar management. A high reproductive capacity of wild boars is based both on early first breeding and on their high productivity. During our research we monitored the situation in the herd that is important for reproduction (the number of units, gender ratio, age, habitat, climate, diet) - we established the number of piglets in litter upon birth as well as the number and gender of live piglets, their body mass upon weaning (day 21). The studies have shown that there are certain differences in the studied parameters, which is the consequence of different farming methods, climatic factors, habitats, and such studies are extremely important both for the controlled farming of wild boars and for their protection in natural environment, as great hunting potential.

Key words: *wild boar, controlled farming, reproduction.*

CITY OF MOSTAR URBAN SELF - SEEDING FLORA VALUE

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Abstract

Floristic exploration of self – seeding plants was conducted on different locations in the city of Mostar (Entity of Federation of Bosnia and Herzegovina, Bosnia and Herzegovina) in vegetation season of 2019. The taxonomic analysis of self – seeding plant species conducted in the city, shows domination of *Asteraceae*, *Fabaceae* and *Lamiaceae* families. Lifespan analysis showed herbaceous perennials domination. According to usable value, most commonly used self – seeding plants are honey plants, culinary plants and ornamental plants. Large number of species has more than one usable value.

Keywords: *Urban flora, medicinal plants, honey plants, poisonous species, herbs and spices.*

WEED FLORA OF ARABLE CROPS IN HERZEGOVINA REGION (BOSNIA AND HERZEGOVINA)

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Abstract

On 34 research localities, over all 51 species of vascular plants from total of 25 families were noted. The highest share had family *Asteraceae* (counting 11 species) and *Poaceae* (counting 5 species). The analysis of biological spectrum of association *Panico – Portulacetum oleraceae* Lozanovski 1962. terophyte -hemipterophyte character could be determined, with slightly higher share of terophytes, and smaller share of hemipterophytes, resulting exclusively from mechanical measures of weed control. In areal spectrum of association *Panico-Portulacetum oleraceae* Lozanovski 1962., 7 groups of flora elements were asserted, among which elements of wide- spread dominate. 32 plant species related to the cosmopolite group of flora elements. 51 weed species related to arable crops in Herzegovina region (Bosnia and Herzegovina) were constituent associations of *Panico-Portulacetum oleraceae* Lozanovski1962., presenting certain floristic affluence in respect to the same association described for other localities. Special emphasis has to be set on species common for all localities which are the typical species of syntaxonomic units (association, alliance, order and class): *Portulaca oleracea* L., *Echinochloa crus-galli* (L.) Beauv., *Setaria glauca* (L.) Beauv., *Amaranthus retroflexus* L., *Chenopodium album* L. and *Solanum nigrum* L. The most common type of strategy in weed flora is R (28.00%), followed by plants of CR strategy (16.00%).

Keywords: *weed flora, CSR strategies, floral diversity.*

THE EFFECT OF NONIONIC SURFACTANTS ON CADMIUM (II) REMOVAL RATE USING BULK LIQUID MEMBRANE SYSTEM

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Abstract

Industrial and agricultural wastewater is a significant source of heavy metal pollution. Application of different membrane systems for selective removal of heavy metal ions from natural resources is very interesting in recent years. One of the most efficient applications of these systems is based on the implementation of the “bulk liquid membrane” (BLM), which includes a combination of three processes: extraction, diffusion, and re-extraction of an analyte. In this paper, the removal of cadmium (II) ions through a liquid membrane system and factors that influence the process were examined. The research was performed using the homemade transport cell. Metal ion concentration in aqueous phases was monitored by flame atomic absorption spectrophotometry, after 3 hours of experiment. Macrocyclic ethers (18-crown-6, benzo-18-crown-6, dibenzo-18-crown-6, dicyclohexane-18-crown-6), were used as ligands for Cd(II) ions. The effects of nonionic surfactants (Triton X-100, Brij 35, Brij 58 and Brij 78) as additional possible carriers within the liquid membrane were investigated. The results showed that surfactants reduced the transport rate, but significant removal of cations from source phase occurred (64% Cd(II) removed using Brij 35 surfactant).

Keywords: *Cd(II) removal, Bulk liquid membrane transport, Nonionic surfactants.*

BIODEGRADABLE WASTE IN FRUIT AND VEGETABLES FACTORIES

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Abstract

Due to increasing demographic growth, industrialization, urbanization and economic development, the demands of the population for food and, therefore, food production are increasing, which is why large quantities of biodegradable waste are generated. Biodegradable waste is a potential energy source using modern processing technologies - biogas that would replace current commonly used fossil fuels (coal, oil, nuclear energy, etc.). In most food plants in Serbia, including one in Jarmenovci village in the municipality of Topola, the problem of what to do with the large amount of biodegradable waste that occurs during the processing of fruit and vegetable waste is expressed, because most food plants in Serbia were built 50 years ago or more, and then biodegradable waste was not viewed as energy. In this experiment, the analysis of biodegradable waste generated in the fruit and vegetable processing plants in Jarmenovci village was carried out. The scientific aim of this paper is to contribute to pointing out the problems of generating large quantities of biodegradable waste and to propose a solution for biodegradable waste.

Key words: *biodegradable waste, energy, processing.*

CORRECTION OF SOLAR RADIATION IN REFERENCE EVAPOTRANSPIRATION MODELING FOR REGION OF BOSNIA AND HERZEGOVINA

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Abstract

Estimation of reference evapotranspiration (ET_o) is an essential key in modern agriculture production. Precise determination of plant water needs under different climatic conditions improves water use efficiency, lowers water supply cost and promotes sustainable agricultural production. There are many different methods for ET_o calculation, but Penman-Monteith is the one that is recommended as a standard method. In this paper, a correction of solar radiation (R_s) data for 18 meteorological stations in Bosnia and Herzegovina within 6 years period (2000-2005) is shown. Since R_s is one of input parameters for ET_o modeling and it is not commonly measured in Bosnia and Herzegovina, two methods were tested for its calculation depending on availability of measured sunshine duration in hours. For meteorological stations without measurement of sunshine duration as Bijeljina, Prijedor, Trebinje, Višegrad, Grančarevo and Novi Grad, the Hargreaves formula was used for R_s calculation, whereas for the calculations at the other stations Angstrom formula was applied. In that way obtained R_s data were corrected by using ratio of the solar to solar radiation on clear sky day (R_s/R_{s0}). Thus, in this work, the correction of solar radiation showed to be a method to improve the calculation of ET_o under different climatic conditions in Bosnia and Herzegovina.

Key words: *Reference evapotranspiration estimation, Solar radiation, Penman-Monteith, Crop water needs.*

AGRICULTURAL LAND AND HEAVY METALS

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Abstract

Intensive agricultural production is characterized by increased use of mineral fertilizers, pesticides, organic fertilizers and other substances to revitalize the soil or to increase the general condition of cultivated plants. The use of these substances increases the risk of accumulation, ie. increasing the concentration of heavy metals in the soil. Other factors, accelerated expansion of industrial plants, intensive transport and expansion of settlements also contribute to the introduction of heavy metals into the soil. Growing plants on land that has an increased concentration of heavy metals increases the risk of harmful substances entering the food chain. The paper presents the results of the analysis of 80 soil samples from 80 plots that were in the system of intensive agricultural production. No increased concentration of heavy metals was found in the analyzed soil samples. So far, in the area of Bosnia and Herzegovina, no symptoms have been seen on cultivated or wild plants due to the increased concentration of heavy metals. The plots from which the samples were taken were targeted because it was assumed that the results of the analysis would confirm the increased concentration of heavy metals. Arable land in Bosnia and Herzegovina is unpolluted and does not contain heavy metals, has a good structure and preserved natural fertility, which is why they are suitable for organic production.

Keywords: *heavy metals, land, intensive production, soil samples.*

HEAVY METAL ACCUMULATION AND CHEMICAL COMPOSITION OF ESSENTIAL OILS OF HYSSOP (*HYSSOPUS OFFICINALIS* L.) CULTIVATED ON HEAVY METAL CONTAMINATED SOILS

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Abstract

Comparative research has been conducted to allow us to determine the content of heavy metals and chemical composition of hyssop oils, as well as to identify the possibility of hyssop growth on soils contaminated by heavy metals. The experimental plots were situated at different distances of 0.5 km and 15 km, respectively, from the source of pollution the Non-Ferrous-Metal Works near Plovdiv, Bulgaria. On reaching flowering stage the hyssop plants were gathered. The content of heavy metals in flowering tips of hyssop was determined by ICP. The essential oils of the hyssop were obtained by steam distillation in laboratory conditions which were analyzed for heavy metals and chemical composition was determined. *Hyssopus officinalis* L. is a plant which is tolerant to heavy metals and can be grown on contaminated soils. Heavy metals do not affect the development of hyssop and the quality and quantity of oil obtained from it. Twenty-two components were identified in the oils. The quantity of identified compounds was shown to correspond to 98.5% and 98.8% of the total oil content. Among the detected compounds, trans-pinocamphone (28,38-29,73%), cis-pinocamphone (19,03-21,37%), germacrene D-4-ol (22,12-24,86%), elemol (5,97-6,28%), and spathulenol (3,08-3,24%) were the major compounds. The results clearly showed that the composition of oil was not affected by soil contamination with heavy metals. The essential oil of *Hyssopus officinalis* L. can be a valuable product for the farmers from the polluted regions.

Keywords: *Contaminated soils, essential oil composition, heavy metals, hyssop.*

SOIL SURFACES AND PLANT COVER SPECTRAL RADIOMETRIC MEASUREMENTS IN LAND RESOURCES SURVEY OF NORTHWESTERN COAST, EGYPT

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Abstract

The spectral parameters and intensity of light reflected by a plant cover or soil surface are utilized in analyzing experimental conditions; evaluating light environments, and characterizing earth surface. The northwestern coast of Egypt is an area characterized by an international interest due to its history and magnificent environment. It is known as being the bread basket during the Greek and Roman periods. Recently, drastic changes prevailed land use leading to diminution of the agriculture importance. Restoration of the area needs to develop a sustainable land resources database. The study investigate the hyperspectral characteristics of soil surfaces and dominant vegetation cover types, finding relations to understand the vegetation structure responding to growth environment, including water and soil characteristics. Hyperspectral indices for collected 20 soil surface sites and associated plant cover types were calculated. Field investigation was also carried out to represent different soil units, plant cover species and phenological stages. Chemical and physical soil properties were determined. Soil survey map was produced including dominant geographic units and soil association. It could be concluded that the study of spectral signature is rather valuable in characterizing both soil and plants covers. Also growth conditions and environment can be predicted via spectral characterization curves, hence supporting land resources survey. The results showed that the studied soils were generally characterized by the presence of *Calcic*, *Petrogypsic* and *Salic* horizons. Soils of the alluvial fans and watershed basins are deep to moderately deep, where salinity is relatively low while CaCO_3 content is mostly over 8%. C. The limiting land suitability factors in the piedmont coastal plains are salinity, soil depth and texture. It was found that healthy cultivated plants induce higher reflectance values, in visible spectral bands, than infected ones.

Key words: *Spectral Radiometry, Survey, Plant Cover, Land Resources, Northwestern Coast Egypt.*

HYDRAULIC CONDUCTIVITY AND SURFACE ADHESION THICKNESS AS INFLUENCED BY SODIC SALINITY IN ALLUVIAL SOILS

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Abstract

The thickness of surface adhesion and hydraulic conductivity at the top layer of soil are important factors that affect the intake rate of the soil surface and in deciding the hydraulic properties of the whole soil. The surface adhesion normally called "surface seal" could be a very thin layer or a diffused layer of several centimeters thick. The relationship between seal thickness (L_1) and hydraulic conductivity values (K_s) depends on the way of arrangement of soil particles and their size and the nature of the soil particles included in the surface seal. This study was aimed to evaluate seal thickness and hydraulic conductivity of soils as influenced by equilibrated different SAR (i.e. 0, 5, 10, 30, 50 and >50) values at electrolyte solutions (i.e. 5 and 50 meq/l). Four soil profiles were done for the study at different locations of the Nile Delta representing Menoufia governorate. Seal thickness (L) and hydraulic conductivity (K) were calculated from a simple experiment in the lab. The experiment involved measurements of soil hydraulic conductivity before and after the removal of the top layer of the soil column, which was considered as a two-layers soil system. The computer program Mathcad was used for solving a number of simultaneous equations equal to the number of unknowns. The unknowns were L_1 , K_1 , L_2 , and P_x (the pressure head at the interface between the two layers of the soil column). In all soils, the obtained results explained that an equivalent hydraulic conductivity (K_e) in the presence of the surface seal (top soil layer present) was significantly lower than the hydraulic conductivity of soil layer underneath the surface seal (K_2). The variations on the seal thickness values may be connected to the effect of soil structure change after treatment by different solutions, fine particles migration to lower layers of soil, soil texture as influenced by clay content and the effect of electrolyte concentrations on pore size distribution.

Keywords: *Surface seal thickness, hydraulic conductivity, salinity, SAR, hydraulic resistance.*

CLIMATE CHANGE AND SUSTAINABLE WATER RESOURCES

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Abstract

In recent times, several studies have shown that climate change is likely to have a significant impact on the availability of freshwater resources. Freshwater-rich regions across the globe are projected to face water scarcity if current reserves are not managed effectively. Traditionally, some regions have been well endowed with large freshwater reserves, but demand for water has already increased manifold over the years due to an increase in agriculture, industrialization, urbanization, population and economic development. This has resulted in water scarcity and water quality problems in some regions. At present, the hydrological cycle is being modified at a rapid pace due to the overexploitation of water resources, changes in cropping pattern, land use, groundwater depletion, seawater intrusion, pollution and water pricing models. Apart from these, there have also been observed changes in the increase in average temperature, humidity and coastal erosion. It is recognized that sustainable water resources development and management is an important and urgent issue to be taken up seriously. Therefore, an objective assessment of the availability of water resources in the context of the future water requirements, impacts of climate change and its variability is very crucial for sustainable development. This paper examines in detail the potential for sustainable management of freshwater resources (adaptation & mitigation) within the constraints of climate change and the intention is to provide a clear message for development practitioners and policy makers in order to enable them to cope with the threats, as well as understand the opportunities, presented by on-going climate change.

Keywords: *Climate change, Adaptation, Mitigation, Water resources water scarcity, Water quality, Sustainable management and development, Policy-makers.*

CHANGE IN QUALITY PROPERTIES OF APPLE DURING COLDSTORAGE

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Abstract

Cooling with uniform and controlled humidity distribution is used to preserve the postharvest quality of horticultural products. It prevents the formation of hot spots within or between bins, and maybe thereby helps to reduce water loss from the fruit, therefore reflecting of its quality. Colour and firmness are considered quality parameters which determine consumer acceptability of fruits such as apples. The aim of this work was to study the effect of relative humidity (90, 95 % and a not fixed range of 55-70%), position of apple inside pallets and cooling time in a coldstorage at 1⁰C on quality properties of Egyptian Anna apple (firmness, color, total soluble solids and reducing sugar). The obtained results showed that, the maximum firmness with high significance for all treatments was (35.16±0.158) N and (23.95±0.158) after 10 and 40 days respectively, at 95% RH for the middle of pallet A in the cooling room. The maximum L* value was (69.815±0.42) at the middle of pallet A at 95% of RH after 10 days cold storage ,while after 40 days it reached (62.875±0.42).The lowest mean value of parameter a* was observed at the bottom of the pallet A(-2.833±0.177) at 90% of RH after 10 days cold storage. The maximum total soluble solids recorded were(10.969±0.058), (10.668±0.058) and (11.005±0.058 %) for apples stored 40 days for the bottom and meiddle of pallet A and the top of the pallet B without control of RH (ranged from 55 to70%) respectively. The maximum reducing sugar values (13.667±0.07), (13.371±0.078) and(13.667±0.078 %) were observed in apples stored 40 days for 90, 95% and without control of RH at the top of pallet B. The concluded results could be summarized: optimum quality properties of stored apples were achieved at 95% of relative humidity and in the middle position of the pallet A after 40 days of cooling.

Keywords: *Relative humidity, Colour, Firmness, Reducing sugar, Total soluble solids.*

RELIQUEFYING OF CRYSTALLIZED HONEY WITH A WARMING CABINET

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Abstract

The honey liquation cabinet is essential, which any bee-keeper should have in order to liquefy the maximum quantity of creamed or whipped honey. The main objective of this study was to develop a honey liquation cabinet to turn honey to a more edible form. This small warming cabinet suitable for the middle (with 30 - 100 beehives) and small beekeepers. Some physical characteristics such as moisture content, density, and viscosity of honey collected from three kinds of plants (alfalfa, cotton and citrus) were considered in this study. The mean moisture contents, density and viscosity at 25°C for honey collected from citrus, alfalfa and cotton were (18.10, 16.98 and 14.74 %); (1.40, 1.41, 1.43 g/cm³) and (48.10, 69.03 and 137.96 poises), respectively. The evaluation included three types of honey collected from three kinds of plants (alfalfa, cotton and citrus); and six powers of light bulbs (80, 100, 120, 140, 160 and 200 watt). It was observed that the lowest liquefying time, h. was achieved with citrus honey and light bulbs 200 watt. The optimum temperatures were observed at bulbs power from 80 to 100 watt, so that by maintaining the honey in a temperature between 32 and 49°C the honey could be liquefied without affecting the original color or flavor of the honey.

Keywords: *development, evaluation, honey, dissolution, physical characteristics.*

IMPACTS OF BUSH ENCROACHMENT CONTROL ON RANGELAND VEGETATION IN THE SOUTHEAST ETHIOPIAN RANGELANDS

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Abstract

The study on the impacts of bush control on rangeland vegetation was conducted in the southeast Ethiopian rangelands. This study was conducted in Raitu district of Bale zone for two consecutive years. Rangeland site encroached by these two acacia species was replicated/divided into three plots, and each plot was subdivided into five sub-plots to receive five treatments: cutting at 0.5 m above ground alone (T1), cutting at 0.5 m above ground and dissecting the stumps (T2), cutting at 0.5 m above ground and pouring chemicals on stumps (T3), cutting at 0.5 m above ground and debarking the stumps down into the soil surface (T4) and control (T5). Data on biomass, species richness, basal and litter covers, soil erosion and compaction, dead and re-sprouted encroaching tree/shrub species were collected. The applied treatments significantly influenced ($P < 0.05$) basal cover, dry matter and the two encroaching tree species. The results of this study showed that T1 and T4 were good in controlling *A. aefota* in that order. T4 and T3 had a significant effect in controlling *A. bussia* in their order. Therefore, controlling encroaching tree/shrub species had created a conducive grazing area with palatable herbaceous species for the livestock. The management of bush encroachment, if sustained, will contribute in stabilizing rangelands and help to minimize the negative effects of feed and food crises in the future.

Keywords: *Bale rangeland, Bush control, Grass and forbs, Vegetation dynamics.*

SOIL ORGANIC CARBON AND TOTAL NITROGEN STOCK RESPONSE TO TRADITIONAL ENCLOSURE MANAGEMENT IN EASTERN ETHIOPIA

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Abstract

Traditional enclosures are widely used by pastoralists in East Africa. However, the response of basic soil properties to the establishment of traditional enclosure management remains poorly understood. The aim of this study was to investigate the impacts of traditional enclosure on soil organic carbon and total nitrogen stock in the Bordade rangelands, eastern Ethiopia. We collected the soil samples from 12 area enclosures and openly grazed areas at a depth of 0 to 15 and 15 to 30 cm. The samples were analyzed for soil organic carbon, total nitrogen and bulk density. We found significant differences between area enclosure and openly grazed areas in soil organic carbon and total nitrogen stock. Enclosure had significantly more 27.5% soil organic carbon and 27.5% total nitrogen stock compared with the area outside area enclosure. Soil organic carbon and total nitrogen stock were significantly higher in the top 0 to 15 cm soil layer compared with 15 to 30 cm subsoil. Overall, the study showed that establishment of rangeland enclosures and the short-term resting period followed by dry season grazing at light stocking rate had the potential to improve soil organic carbon and total nitrogen stock, which was an option for realizing positive vegetation changes supporting the local pastoral economy in the semiarid rangelands of eastern Ethiopia.

Key words: *Carbon sequestration, enclosures, sequestration, total nitrogen stock.*

THE EFFECT OF ZEOLITE ON A LIGHT SOIL'S MOISTURE CHARACTERISTIC CURVE

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Abstract

Water scarcity is a common phenomenon in the European Union. The Mediterranean countries, in particular, are facing high water stress, and climate change effects further exacerbate the problem. Agriculture uses over 70% of globally allocated freshwaters for irrigation. Potential irrigation water savings is, therefore, of paramount importance. Zeolites are known for their water holding capacity. Their application to agricultural soil is expected to raise soil moisture, thus leading to irrigation water savings. The aim of the present study was to evaluate the effect of a natural zeolite (85% clinoptilolite) on the water holding capacity of a loamy sand soil, via the estimation of the soil moisture characteristic curve (SMCC). A SMCC is an important hydraulic property, playing a key role in water management. The SMCCs were estimated in the laboratory under controlled conditions, applying known pressures to soil cores, using a pressure membrane extractor. The soil cores were produced from disturbed soil samples. Two application rates of zeolite were used (0.1 and 0.5% w/w) and non-amended soil was used as control. The results showed that the addition of zeolite increased soil moisture content at all applied pressures up to 3 bars. The application of zeolite to a light soil, even at these relatively low rates of 0.1 and 0.5% w/w, increased the available water holding capacity by 26% and 39%, respectively, thus indicating significant irrigation water savings.

Keywords: *Field capacity, Permanent Wilting Point, Available moisture, Loamy sand soil, Clinoptilolite.*

ESTIMATES OF SOIL HYDRAULIC PARAMETERS AS INFLUENCED BY WEIGHTING SOIL-WATER RETENTION CURVE DATA

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Abstract

The un-weighted least-squares regression (ULS) is the most common method applied for fitting the soil-water retention curve (SWRC) functions to the observed data-points to optimize their parameters. However, the variance of SWRC data varies in different moisture contents and therefore, unlike the wet-end of SWRC, the conventional ULS method may not be sufficiently effective in estimating its dry-end. Accordingly, the objective of this study was to investigate the effect of weighting the SWRC data points on increasing the accuracy of the estimated soil hydraulic parameters in the simulation of soil water redistribution. Furthermore, the impact of SWRC estimation by either ULS or the weighted LS (WLS) was investigated on the calculation and evaluation of selected soil physical quality indicators (SPQIs). SWRC of the studied soil samples was measured in six replications and was fitted to SWRC equation to optimize its parameters either through WLS (by properly weighting the data points) or the conventional ULS methods. The obtained parameters were compared in terms of their differences in the simulation of soil water flow and in the interpretation of selected SPQIs as well. Results showed that even though WLS generally increased the error of SWRC estimation ($RMSE=0.0266$ and $0.0432 \text{ cm}^3 \text{ cm}^{-3}$ in ULS and WLS methods, respectively), increased the accuracy of the estimation at lower moisture contents (dry-end) in compared to ULS. From a practical point of view, the method we used to obtain soil hydraulic parameters imposed a significant impact on the evaluation of given soil behavior. Estimation of SWRC and its related hydraulic properties through WLS resulted in different values of SPQIs (for example S -index = 0.033 and 0.042 or RFC (relative field capacity) = 0.573 and 0.621 in the ULS and WLS methods, respectively) which indicated soil conditions in providing a suitable supply of air, water, and nutrients for plants. Furthermore, weighting SWRC data considerably affected the simulation results of soil water movement in either wet or dry moisture conditions.

Keywords: *HYDRUS model, RETC code, Soil physical quality, Soil water flow simulation, Un-weighted least squares, Weighted least squares.*

NATURAL CAPITAL AND PANDEMICS: CASE OF COVID-19

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Abstract

The COVID-19 pandemic had a wide impact on lives, economies and common home. In this context, a debate is arising on the causes of pandemics spread. This article highlights how some interpretations and the consequent decisions might affect the natural capital and ecosystem services. It considers the multifaceted relations between pandemics and natural capital and examines how the lessons learnt from past zoonoses can inspire future actions to manage in a nature-based and environmental-sound way the post-COVID-19 recovery. The ongoing debate focuses on whether the pandemic spread and spillover started because of habitat destruction or because of a too intensive and unregulated proximity between wildlife and humans in urban centres. These two hypotheses are analysed to identify misleading interpretations that might affect the effectiveness of the recovery actions. The paper suggests a recovery strategy that considers the 'One Health' approach and minimise negative impacts on the livelihoods of vulnerable communities. An integrated approach to 'green recovery' that mitigates the pandemic impacts on natural capital is crucial to achieve the Sustainable Development Goals (SDGs).

Keywords: *COVID-19; Pandemics; Natural capital; Zoonosis; Biodiversity.*

ATTITUDINAL FACTORS AFFECTING THE ADOPTION OF SOIL AND WATER CONSERVATION MEASURES: TOWARDS AN APPROPRIATE METHODOLOGICAL APPROACH

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Abstract

Soil and water are essential resources for agricultural production. However, water and soil conservation has become critical in many agricultural areas. Despite that, the rate of adoption of soil and water conservation measures among farmers is unsatisfactory. Therefore, there is an urgent need to understand the factors that affect the acceptance and adoption of such measures. In this context, this review paper provides an overview on the theoretical frameworks used in the analysis of the adoption of water and soil conservation measures (WSCM) with a particular focus on attitudinal factors. Different models and frameworks have been used in the analysis of the acceptance and/or adoption of new technologies and measures e.g. Technology Acceptance Model (TAM), Motivational Model (MM), Theory of Reasoned Action (TRA) and Unified Theory of Acceptance and Use of Technology (UTAUT). However, the paper argues that using models with more attitudinal components as well as integrating different conceptual models can allow to better understand the multifaceted and intricate adoption process. In this respect, the integration of UTAUT with Initial Trust Model (ITM) seems promising and can provide for a profound understanding of the acceptance process and behavioral intention. The integration of the UTAUT and ITM models has not been used so far in investigating the acceptance of WSCM. The attitudinal components involved in the UTAUT model are performance expectancy (PE), effort expectancy (EE), social influence (SI), perceived risk (PR), perceived cost (PC), facilitating conditions (FC), resistance to change (RC) and behavioral intention (BI), while the constructs of ITM model are initial trust (IT), perceived structural assurance (PSA), propensity to trust (PT) and firm reputation (FR). The paper concludes by making the case for testing the proposed methodological approach in different real-world contexts to assess its suitability and validity.

Keywords: *Technology adoption, Water conservation, Soil conservation, Unified Theory of Acceptance and Use of Technology, Initial Trust Model.*

METHODOLOGICAL PROPOSALS FOR ADDRESSING AGROECOLOGICAL DESIGN IN PERIURBAN AREAS: A CASE STUDY IN THE EDGES OF MILAN (ITALY)

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Abstract

This study aims to develop an ecological-based design model, applying the theoretical basis of Landscape Ecology and Phytosociology on a pilot area located in the Milan South-Eastern rural edges. The goal was to integrate an all-inclusive approach for agroecological regeneration. Three main guidelines were identified: 1. the rehabilitation of landscape texture; 2. internal diversification; 3. environmental consistency. The study led to a global evaluation of the ecological functionality of the environmental compartments, analysing their weaknesses and resiliences. Consequently, design criteria were defined, regarding the landscape level and the single ecotope level, reconfiguring the current uses and functions and enhancing the biological and structural diversity within the agroecosystem. Finally, an evaluation of the benefits on ecological functionality was carried out, as well as a qualitative assessment of the ecosystem services that can be delivered. This approach enabled to make direct comparisons between actual and project scenarios, supporting the readability of the rebalancing effects attainable on the environmental, social and economic scale.

Keywords: *Landscape ecology, Agroecological design, Ecosystem services, Peri-urban, Italy.*

**FENCING LANDS TO ENHANCED CLIMATE CHANGE RESILIENCE,
PROMOTING BIODIVERSITY REGENERATION AND IMPROVED
LIVELIHOODS OF CLIMATE CHANGE IN MAKUENI COUNTY IN KENYA**

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Abstract

Kenya is a food insecure country, weather patterns are drastically changing and people are losing livelihoods and earnings when their lands dry, water for domestic supply lacks and livestock die further frustrating livelihoods of the poor. This paper briefly discusses Fencing of lands as prerequisite to biodiversity protection and faster water retention mechanism, through tree planting, enhancing CO₂ sequestration as trees, shrubs and vegetation's find suitable environment to grow. Baringo and Makueni County are characterized by unsustainable agriculture, environmental degradation resulting from soil erosion, high poverty levels and food insecurity due to unpredictable dry spells and climate change. The present paper illustrates that Fencing of lands improves agricultural land management practices, biodiversity growth increased soil carbon sequestration.

Key words: *food security, soil carbon sequestration, climate change, soil erosion.*

THE SUCCESSFUL INTRODUCTION OF SALT TOLERANT CROPS UNDER SALINE GROUNDWATER CONDITIONS IN COASTAL LEBANON

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Abstract

Water scarcity and increased water demand encourage the use of nonconventional water resources. Farmers on the Lebanese coast use groundwater for irrigation. Excess pumping leads to seawater intrusion and salinization of groundwater, which restrict crop choice for local farmers. The IAEA program “ARASIA” was launched in 2016 as a regional project RAS5080, supported by CNRS, for the adaptation of effective measures to combat desertification in 11 Arab Member States from West Asia. The multidisciplinary project which includes research centers, academia and farmers has been working on the introduction and testing of salt tolerant crops. Seeds of millet, tomato, cucumber, eggplant and okra were provided by ICBA. This work reports on the introduction of forage millet and okra. Irrigation using saline groundwater consisted of four treatments: 3-6-9 and 12dS/m. Fertigation between 2016 and 2019 was done using tensiometers, ETc and neutron probe. Nitrogen use efficiency was tested using ¹⁵N. In addition to crop development and biomass production, observation included canopy temperature and chlorophyll content. Obtained results showed good performance for forage millet and okra at 9 and 12 dS/m with higher biomass production and efficiency of nutrient and water use. We will continue national and regional cooperation within the IAEA-RAS project to support capacity building and transfer of modern tools and skills on saline water stewardship in agriculture. The project helps farmers adopt good practices for sustainable management of water resources in the MENA region. With competing land-uses, developing farmers’ resilience is a requirement for land conservation and ecosystem functions on the Mediterranean coast.

Keywords: *Salinity, Coastal land degradation, Sustainable agriculture, Isotope techniques, Adaptation to climate change.*

LIBYA BETWEEN WATER POVERTY AND WEALTHY OF PETROL: CHALLENGES AND PROSPECTS

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Abstract

Before the discovery of oil in Libya in 1958, the agricultural sector accounted for 25% of the economic activity, the population only was 1.2 million in 1952. Libya is the 16th largest country in the world. Libya discovered oil in 1959 and started exporting oil in 1961. Libya joined the (OPEC) in 1962. In 1959 oil was discovered in Libya by ESSO USA company (renamed EXXON) and production and export of oil in commercial quantities began in 1961, and as a result, the Libyan economic situation changed dramatically. The Libyan economy became primarily dependent on the revenues from the oil sector, which constituted practically the whole of the export earnings, and 70% of the country's GDP in 2005. The yields from oil exports and its small population gave Libya one the highest GDPs per capita in Africa. While searching for oil by American companies led at that time (1950^s) they discovered large quantities of groundwater found in the middle of desert (heart of desert) south of Libya in the depths of the desert. From here Gaddafi decided to establish the largest water transfer project in the world later called the Great Man-Made River Project. The project cost was \$ 30 billion, funded by the Libyan government without loans.

Keywords: *Water, Petrol, Libya, Great Man Made river.*

THE IMPACT OF THE METEOROLOGICAL FACTORS ON CROPS WATER CONSUMPTION AND VERTICAL MOISTURE EXCHANGE IN SOIL

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Abstract

A various number of factors, which, in turn, also vary greatly, determines the process of water consumption. These are meteorological indicators, yield, crop properties and soil conditions. The values of the water consumption of irrigated crops (in the operational regime of irrigation in the calculation of the water balance) are recommended to be determined counting on: the indicators of heat supply of the territories, that is, the radiation balance; air humidity deficit and bioclimatic factors of water consumption, taking into account the type and phase of plants development, the physical condition and the soil moistening. The empirical method for determining the vertical moisture exchange takes into account the biological characteristics of crops, the conditions for the heat and moisture availability of the calculation periods, the power and humidity of the soil layer under study, the water-physical properties of the ground, and the depth of the groundwater. It gives reliable results and can be used in calculations of the water regime in designing and exploitation of the reclamation systems. The groundwater affects the formation of the soil water regime in the aeration zone. At shallow occurrence, they increase the humidity in the root layer, which makes it possible to reduce the irrigation rates and the number of irrigation events. The empirical method for determining the vertical moisture exchange takes into account the biological characteristics of crops, the conditions for the heat and moisture availability of the calculation periods, the power and humidity of the soil layer under study, the water-physical properties of the ground, and the depth of the groundwater. It gives reliable results and can be used in calculations of the water regime in designing and exploitation the reclamation systems.

Keywords: *Irrigation, vertical moisture exchange, water consumption, basin recharge, infiltration.*

ENVIRONMENTAL RISK ASSESSMENT OF WATER AND SOIL IN LITHUANIA

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Abstract

The inventory of sources of pollution started in Lithuania back in 1990–1995. At that time, the main focus was on the inventory and examination of landfill sites and former Soviet Union military bases, and former warehouses of pesticides. Law on Environmental Monitoring was adopted in 1997. It regulates not only the state environmental monitoring, but also the requirement applicable to economic entities (the potential polluters) to carry out the monitoring of the impact on the environment as well as groundwater. Nowadays, soil and groundwater may be polluted by approx. There are 11 thousand contaminated sites in Lithuania, and approx. 4.5 thousand of them have very high potential for pollution. The total estimated area of polluted land is about 280 m², or 0.43 % territories of the country. Contamination of Lithuania's sites emerged from both previously and currently pursued industrial, commercial and intensive agricultural activities. The measures implementing the Nitrates Directive are set out in the water field development program for the period 2017-2023 and implementation plan of the water field development program for the period 2017-2023. According to the last report on the implementation of the Nitrates Directive (2012-2015), nitrate levels in surface water and groundwater remain low in Lithuania. However, eutrophication of surface freshwater remains problematic, with a slight increase. Contamination can severely reduce soil quality and threaten human health or the environment. Lithuania has carried out a thorough mapping of potentially contaminated sites. This serves as the basis for remediating these contaminated sites under the national environment protection strategy (2015) and management plan of contaminated sites for 2013-2023, approved by the Minister of Environment.

Keywords: *Quality, contaminated sites, water, soil, Lithuania.*

CARBON SEQUESTRATION AND SELECTED HYDRAULIC CHARACTERISTICS UNDER CONSERVATION AGRICULTURE (CA) AND TRADITIONAL TILLAGE PRACTICES IN MALAWI

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Abstract

Conservation agriculture (CA) is increasingly promoted among smallholder farms of sub-Saharan Africa in a quest to improve food security, while sustaining the natural resource base of the agro-ecosystems where agriculture is based. The aim of this study was to investigate the effects of CA and Traditional tillage (TT) on soil organic carbon and selected hydraulic properties in two contrasting agro-ecological zones of Malawi. Six farmers hosted the on-farm trials in each location, with each farmer having the following treatments: CA with continuous sole maize (CA-SM), CA with maize-legume intercrops (ML-CA), and conventional tillage continuous sole maize (CT-SM). Soil samples were randomly collected in October 2015, from farmers' fields located in Chipeni, Chinguluwe, Lemu, and Zidyana implemented for 10 years. Triplicate undisturbed soil cores were randomly collected per plot and replicate to a depth of 20 cm for water characteristics and pore size distribution determination. CA-ML gave 35%, 33% and 73% more total SOC than CT-SM in Chipeni, Lemu and Zidyana, respectively. In the humid region of Zidyana, CA-ML gave 0.05 Mg ha⁻¹ more carbon stock than CA-SM while CA-SM gave 0.02 and 0.03 Mg ha⁻¹ more carbon stocks than CA-ML in Chipeni and Lemu, respectively. CA-ML and CA-SM increased POMP by 180% and 120% and POMR by 108% and 63%, respectively compared with CT-SM. Both CA-SM and CA-ML improved soil porosity, pore size distribution, and soil plant available water by increasing the total porosity and the proportion of meso and micro pores compared with CT-SM. It can be concluded that changing management practices from CT-SM to CA has the potential to improve the soil organic matter as well as soil hydraulic properties across agro-ecological zones in Malawi which is important for the sustainability of Malawi's agriculture.

Key words: *Conservation agriculture, traditional tillage, carbon sequestration, hydraulic characteristics, smallholder farmers.*

PAPADAKIS METHODOLOGY FOR THE AGROCLIMATIC CHARACTERIZATION OF CHIAPAS STATE, MEXICO

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Abstract

The distribution of agricultural production in the territory depends mainly on the climate; hence agroclimatic characterization is essential for regional agricultural planning. Chiapas has a diversity of climates due to its two large mountain systems, separated by a depression, with altitudes from 0 to >2,200 masl. An agroclimatic characterization was carried out in the state of Chiapas to know the agroclimatic potential and contrast with the current geography of the crops. The methodology proposed by Papadakis and the Climatic Norms (1951-2010) of 106 meteorological stations of the National Meteorological Service were used. The agroclimatic characterization was carried out defining the monthly and annual climates, types of winter and summer, water regime and current distribution of crops. The results were 7 types of tropical climates regimes and 3 of cold lands; 5 types of winter, from *Equatorial* to *Citrus* in the plateaus (> 2,000 masl), 4 types of summer, from *Torrid Cotton* to *Maize* on the plateaus (> 1,900 masl); 4 water regimes, from *Wet* to *Dry Monsoon*. Tropical climate regimes are distributed in 88.6% of the territory, with the *Continental Savanna* climate being the most representative (28.2%) in the coastal plain and central depression. Here, there are banana, oil palm, mango, cocoa, sugar cane, rambutan producing areas, with significant differences in the water balance during the growing season. The cold lands represent 11.4% of the surface and are located on the Comitaca plateau and Chiapas plateaus (1,000 to 2,800 masl) with a low risk of frost; maize, coffee and cryophilic crops with low chill hours requirements are grown on these lands. Water variations are also significant. The coldest climatic type is *Subandino*, located in the Chiapas mountain range (> 2,800 masl). The Papadakis system generates crop recommendations consistent with the existing status.

Key words: *Water balance, Agroclimatology, Agricultural planning, Tropical crops, Climates of Mexico.*

ASSESSMENT OF METALLIC POLLUTION USING THE GIS APPROACH AND POLLUTION INDICATORS IN AGRICULTURAL SOILS WATERED BY WASTEWATER FROM DAY RIVER IN BENIMELLAL, MOROCCO

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Abstract

Among the most widespread problems in the world, we mention the problem of wastewater irrigation. This use seems to be the solution to compensate for the need in water. However wastewater contains undesirable chemical elements that can accumulate in the soil. The purpose of this study was to assess the pollution of agricultural soils watered by wastewater from Day River in Beni Mellal. To achieve our objective, 35 samples of agricultural soils with a depth of 0-20 cm were analyzed to determine some physicochemical characteristics of the soil (OM, CaCO₃, pH, EC, texture) and a set of heavy metals (As, Cr, Cu, Cd, Ni, Pb, Zn, Hg and Fe). The level of pollution was assessed using Geographic Information Systems (GIS), and some pollution indices such as: Geo-accumulation indices (IGEO), Enrichment Factor (EF), Contamination Factors (CF), Pollution Load Index (PLI) and Potential Ecological Risk Assessment (RI). The results of the analysis showed that the agricultural soils had a clayey to silty-clay texture, alkaline pH, rich in organic Matter (OM) and calcium carbonate (CaCO₃) with high concentrations of metallic elements (As: 8.24 mg/kg, Cr: 77.77 mg/kg, Cu: 87.40 mg/kg, Cd: 4.89 mg/kg, Ni : 42.33 mg/kg, Pb: 109.66 mg/kg, Zn : 75.98 mg/kg, Hg : 146.50 mg/kg and Fe: 26248.18 mg/kg) showing that Cd and Pb concentrations exceeded the WHO and FAO limits. We take note that the highest concentration levels of heavy metals were found around areas located near Day River source, and the points where it crossed villages in Beni Mellal suburb. The Igeo, EF, CF, PLI and RI indices and the spatial distribution of the heavy metals revealed medium to high contamination of the soil by heavy metals and this contamination came from anthropogenic origin related to irrigation by wastewater and the intensive land use in agriculture as well as to the influence of the soil properties such as organic matter, pH and clay mineralogy.

Keywords: *Day River, wastewater, metallic pollution, pollution indices.*

EFFECT OF WATER SALINITY AND FREQUENCY OF IRRIGATION ON ELECTRICAL CONDUCTIVITY OF THE SOIL

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Abstract

Irrigation with saltwater, continuously over time, affects the the soil quality causing a destructive effect on it and making it unsuitable for farming in the future. In this context, our work aims to study the influence of water salinity and the frequency of irrigation on the distribution of salt on the heavy soil layers of Tadla. The test was carried out in the field on the experimental farm of the Tadla regional agricultural research center Morocco, between November 2018 and December 2019. Three crops were irrigated with different quality of water, sugar beet with water of 0.7; 4 and 8 dS/m, fodder corn 0.7; 2; 4 and 6 dS/m and red pepper (1.5; 3 and 5 dS / m). The result showed that the layer 30-40 cm accumulated the maximum of salt. There was an increase in the electrical conductivity of the soil of 2.7 dS/m in the case of irrigation with water of $EC_w = 4.5$ dS/m in the case of red pepper, and an increase of 3.7 dS/m for the soil which was irrigated with an $EC_w = 6$ dS/m case for corn. For sugar beet which was a salinity tolerant crop, the layer 20-30 cm accumulated the maximum of salt with an increase compared to its first state of 4.45 dS/m in the case where the soil was irrigated with an $EC_w = 8$ dS/m.

Keywords: *salinity, water quality, soil.*

WASTE COMPOST QUALITY ASSESSMENT FOR EFFICIENT USE IN AGRICULTURE. CASE OF THE KHENIFRA REGION - MOROCCO

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Abstract

This study is to evaluate the solid waste composts the quality in the Khenifra region and to use them as an organic amendment. Composting tests were undertaken at the household waste disposal and recovery site in the Khenifra city. When it enters the site, the waste undergoes a physical treatment which consists of manual sorting in order to remove the coarse elements, by screening through a sieve with an 80 mm mesh in order to reduce the heterogeneity of the garbage housewives. The fermentable organic matter resulting from these treatments is put back into windrows. A turnaround every two weeks in order to gradually homogenize a heterogeneous waste at the start, and watering helps maintain high humidity. The evaluation criteria on which they were based were: maturity, particle size, organic matter, heavy metals and pathogenic microorganisms. The results showed that the C / N ratios varied in the range of 13% -15% and showed that the composts obtained were mature. The pH is slightly basic and varies between 7.9 and 8.1. Fine particles represented 61% while particles > 2 mm in size had a proportion of about 40% confirming this result. The average organic matter content in composts was approximately 19-20%, carbon 12%, nitrogen 0.77%, perfectly complying with international standards. The results for heavy metals also showed relatively high values, but remain within the standards. Microbiological analyses revealed the presence of fecal coliform bacteria (*Escherichia* and *streptococci*) and fungi of the genus *Aspergillus*. In general, the composts produced by solid waste in Khenifra are of good quality and can be used as organic fertilizer for the soil. A simple pre-treatment of the compost and a germination test are then necessary.

Keywords: *Compost of Solid Waste, Compost Maturity, Khenifra region.*

EFFECT OF PHOSPHORUS-SALINITY INTERACTION ON THE GROWTH AND PRODUCTIVITY OF A TADLA CROPPING SYSTEM: EXPERIMENTAL APPROACH AND MODELING

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Abstract

The irrigated perimeter of Tadla is one of the areas in Morocco affected by the salinity problem of both soils and groundwater limiting agricultural production. Several studies reported in the literature have highlighted the role of phosphorus in mitigating the effects of salinity on crops. This work aimed to investigate the response of germination and growth crops to different salinity levels of irrigation water, to study the possible role of phosphorus in mitigating the effect of salinity on crop growth and yields and to test the usability of the model SALTMED on data from field experiment in order to evaluate the importance of specific management options in a drip irrigation system with saline water. This research was conducted in Tadla Morocco (INRA) between December 2018 and July 2019. This research was conducted in pot trial and in the field at the same time. Farmers surveys aimed to determine the list of crops that would be tested and found out more about agricultural practices followed by farmers to limit the effects of salinity on crops. Pot trial aimed to study the effect of the interaction of the two factors on the germination of the three crops (wheat, sugar beet and silage maize). Concerning the Modeling, it is integrated in this study to adapt the SALTMED model to water and salinity transfers modeling and use it as a decision support tool. It will also determine the yield decrease corresponding to each salinity level.

Keywords: *Salinity, Phosphorus, Modeling (SALTMED), Interaction, Tadla perimeter.*

EFFECT OF SALINITY ON PLANT GROWTH OF CACTUS 'OPUNTIA FICUS-INDICA' VARIETY 'AISSA', IRRIGATED WITH TREATED WASTEWATER IN THE REGION OF SOUSS-MASSA, MOROCCO

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Abstract

Our work aims to evaluate the salinity resistance of the *Opuntia ficus-indica* (L.) Mill cactus, variety 'Aissa', as well as the feasibility of using treated wastewater for the irrigation of potted cactus cuttings. Three salinity levels were tested: T1: 1.5 dS/m, T2: 3 dS/m, T3: 4 dS/m, and T0: 1 dS/m (fresh water as a control sample). Using treated wastewater with a salinity of 3 dS/m, the pH and electrical conductivity of the substrate increased by 9% and 42.6% respectively, while in plants irrigated with fresh water, the same substrate parameters achieved increases of 6,7%, 17,5%. The concentration of total nitrogen, potassium and magnesium in the substrate tended to decrease in all the treatments. However, the concentration of sodium in the substrate was increased with the salinity of the irrigation water. The results obtained showed that salinity had a negative effect on most of the growth parameters studied. Total nitrogen, potassium, phosphorus contents and dry matter of prickly pear cladodes decreased when the salinity reached 3 dS/m, while the sodium concentration increased and exceeded the standards established by the FAO (0.02-0.04% of dry matter). Our results also indicated that over a salinity level of 3 dS/m the bud release capacity decreased significantly (up to %?), as well as the speed of bud growth at the surface. The results of our trial indicate that irrigation with treated wastewater with a salinity level of 1.5 dS/m stimulates the physiological activity of the cactus of the variety 'Aissa' and can be considered as an optimum threshold for its growth and development.

Keywords: *Cactus, Salinity, Plant growth, Irrigation, Treated wastewater, Souss Massa.*

SILICON: ITS CONTRIBUTION TO NIGELLA SATIVA (L) CULTIVATION UNDER SALT STRESSED ENVIRONMENT

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Abstract

Nowadays, due to the concurrence of diverse biotic and abiotic stresses, the growth of plants may be adversely affected. Silicon (Si) is considered as the multi-talented element by respecting the environment and improving the plant to wrestle various biotic and abiotic stresses, it enhances plant growth by improving physiological, metabolic, and molecular responses. This study inquires the effect of Si application on black cumin *Nigella sativa* (L) grown under salt stress. Therefore, growth experiments were conducted with seeding in pots with 100 mM of NaCl and 1 mM of Si. The Randomized Complete Block (RCBD) was the experimental design used in this study with three repetitions. Our results exhibited that the application of Si boosted significantly the physiological studied parameters in saline treatments compared to the same treatments without Si. The Si addition ameliorated the relative water content (RWC), and the total phenolic content. Moreover, it increased the concentration of K⁺ in leaves by 50% and K⁺/Na⁺ ratio by 61% in presence of NaCl. These results suggested that Si application would contribute to maintain *Nigella sativa* cultivation under salt stress conditions, and it could be an ally for the valorization of regions affected by salinity, the same as adaptation of this species under the climate change.

Keywords: *Silicon; Nigella sativa* (L); *Salinity; Tolerance Mechanism; RWC; K⁺/Na⁺ ratio.*

DEVELOPMENT OF A PASSIVE SOLAR SYSTEM FOR HEATING GREENHOUSES

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Abstract

Greenhouse heating is a necessity especially in winter season when the air temperature inside greenhouse could be below the good crop development conditions. The research of alternative clean energy sources for greenhouse heating has become nowadays more and more actual, due to high heating loads and the rising price of fossil fuels. Among the alternative energies to fossil fuels, the solar energy is the most cost-effective and viable to heat greenhouses in south Mediterranean basin. It is in this context that we have studied the performance of a passive solar heating system in Multi-span Moroccan greenhouse for tomato production, in order to assess the effect of such system on the microclimate, tomato yield and Tuta Absoluta population. The passive solar sleeves use water as a collection and storage medium. The water is stored in black plastic sleeves positioned on both sides of crop rows near the roots. With this system, excess transmitted solar heat is passively stored during the day in the water of the solar sleeves and is released during the night, also passively. Comparison of results between two greenhouses (one equipped with the solar heating system and the other without) show that during the night, this system increased the greenhouse air temperature by 3.9 °C and reduced the air relative humidity of the greenhouse by 8.5 %, also this system increased the yield of fresh tomatoes by 30.7 % compared to the control greenhouse. In addition this system has a positive effect in terms of reducing the risk of the Tuta Absoluta development, due to the lowering of air humidity inside the greenhouse.

Keywords: *solar energy, solar heating system, greenhouse, tomato.*

THE LIVELIHOOD DIVERSIFICATION STRATEGIES, LANDSCAPING OF A TYPICAL FISH FARMS IN GWAGWALADA ABUJA, NIGERIA

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Abstract

The study examined the different livelihood diversification strategies, landscaping of a typical Fish farms located in Gwagwalada (Compensation Layout Old Kutunku Abuja Nigeria). In order to realize the objectives of the study, primary data were obtained from farm workers, buyers, the owners of the fish farm, with the aid of structured questionnaire, many farm visit were made, pictures were taken and persons were interviewed. We observed the consumption rate of feeding of the fish in the morning and late in the evening. Persons taking care spread the fish feeds to the ponds and, the dead fish floated on the water consumed by the living fish. We also saw that banana was planted to produce shield for the fish farm. Fish fences were newly introducing to protect it from the dangerous animals and birds being feed. There are also farm steads, where the farmers lived and there are planted of grasses to control the soil erosion and make the pond to be strong. Thus, a significant relationship between households' food insecurity and livelihood diversification strategies is established.

Keywords: *Livelihood, diversification, Strategies, Landscaping, Fish farms, Nigeria.*

AN APPRAISAL OF THE HONEY MARKETING PRACTICES IN GWAGWALADA AREA COUNCIL OF THE FEDERAL CAPITAL TERRITORY, ABUJA, NIGERIA

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Abstract

reported that honey production played a very important role as a source of increasing rural income in sustainable development in Turkey. In comparative analysis of beekeeping and crop production in Adamawa state in Nigeria, farm budgeting analysis and descriptive statistics revealed that beekeeping was a far more profitable and cost effective way of farming among the respondents. Apiculture has been appraised in some parts of Nigeria and other parts of the world with remarkable success in terms of profitability. Many products can be found in bee keeping, but the most demand and supply of the products is the honey in Gwagwalada of the Federal Capital Territory, Abuja. This paper therefore evaluated the different marketing strategies being used by the sellers, the various constraints involved in the methodology that was used, such as the pricing, the preservation technology and selling points. This study was carried out in Gwagwalada. The targeted groups for the study consisted of the sellers, buyers and users in Old Kutunku, University Abuja side and Gwagwalada markets. The survey was carried out between June 2013 and July, 2014. The 360 questionnaires were coded and analyzed. Descriptive statistics such as frequency, distributions, percentage and means were used to present the results. Structured oral interview was used to obtain information from the respondents and pictures were taken. Findings revealed that most of the honey that was purchased by buyers was sold using the used bottle water container. Packaging systems were poor during the time of sells, the buyers used to taste the quality of the honey. There were no special and good displays of the honey and the preservation was very poor. Then, marketing of the honey products became a challenging factor affecting the profitability of the sellers, including the preservations and transportation methods. The majority of the respondents agreed that there were needs for good technology practices that would involve good packaging system to promote good display and encourage buyers and easy transportation. This paper therefore recommends the establishment of a factory that will design a good packaging system to aid marketing of the honey for profitability among the sellers, while the buyers will be able to have quality honey. With this, the seller will be able to make profits.

Keywords: *honey, marketers, buyers, Gwagwalada.*

TRIBAL LEADERS' ROLE - A FIRST-HAND EFFECTIVE WAY FOR BETTER MANAGEMENT OF PROTECTED AREAS IN PAKISTAN

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Abstract

Protected areas (PAs) are being considered as a promising strategy for the conservation of biodiversity and ecosystems across the globe. However, the effective management of these PAs has remained the prime concern of many nations, especially developing countries where effective governance is a major challenge. This paper provides empirical evidence on the substantial role that tribal leaders play in the management of these PAs. Based on data collected from three PAs in Pakistan, we investigated the tribal leaders' role in PA management. We surveyed 300 local community members and conducted 24 expert interviews to assess the influence of tribal leaders as stakeholders in PA protection. The result revealed that 22% of the total respondents rated tribal leaders as the most influential stakeholder group for the overall protection of PAs followed by the local community (18%), donor/non-government organizations (16%) and the government (14%). Of the PAs investigated, the Torghar PA, led by tribal leader, was ranked as the best in the context of conservation of flora and fauna species. Overall, the ratings for vegetative cover (55%), forest status (38%) and wildlife species status (56%) were higher in Torghar than in the Chiltan PA (48%, 17% and 41%, respectively) and the Ziarat PA (42%, 25% and 21%, respectively). We recommend that the role of tribal leaders should be considered as an important component in PA management and should be considered in global management frameworks such as the Management Effectiveness Tracking Tool and the Sustainable Livelihood Framework.

Key words: *Protected Areas, Conservation, Tribal Leaders, Biodiversity, Balochistan.*

BIOMETHANE PRODUCTION FROM SILKWORM WASTE INCLUDING ENERGY CALCULATION

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Abstract

In view of the increasing demand of organic agriculture, utilization of waste and environmental protection, sericulture focuses not only on the cocoon production, but also on other ways that can benefit the farm's economy. It is necessary to find new sources of income for small-scale farmers not only through cocoon selling, but also by the multiple uses of by-products. Insect farming technology provides a cheap source of biomass, which may be a good material in biogas production. Laboratory analyzes showed that the examined substrates, both silkworm breeding waste and caterpillar excreta, generated a biogas yield comparable to other substrates of agricultural origin, such as cattle, pig and chicken manures. Fermentation of silkworm excreta under mesophilic conditions produced 167.32 m³/Mg TS of methane and 331.97 m³/Mg TS of biogas, while fermentation of silkworm breeding waste yielded 256.59 m³/Mg TS of methane and 489.24 m³/Mg TS of biogas. Moreover, the energy calculation of biogas production from these raw materials was made. Waste from silkworm breeding was characterized by a higher energy potential than silkworm excrement. Per 1 Mg of silkworm excrement dry mass, the produced energy amount was 0.61 MWh and 2.52 GJ of heat. For silkworm breeding waste, the results were 0.94 MWh and 3.87 GJ.

Keywords: *Bombyx mori L.*, breeding waste, excreta, biogas, methane fermentation.

MONITORING NOXIOUS SUBSTANCES FROM COMBINED FEED FACTORIES FOR ENVIRONMENTAL MANAGEMENT

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Abstract

Compound feeds are an important source of food for the animals from zootechnical farms, because in addition to ground cereals they also contain vitamins, minerals, proteins, amino acids, and sometimes even drugs, energizers or flavors. The process of obtaining different varieties of compound feeds involves a complex technological flow, with specific stages of production. Mixing, sterilization and granulation activities, where steam jets are used at very high temperatures determine the elimination of different types of noxious substances in the air. In this article are presented the experimental measurements performed at the critical points of working installations from a compound feed factory, on the entire duration of the assortment lot. Considering the purpose of the performed researches, the critical measurement points were established at the exit of steam generator, where steam jets are obtained at very high temperatures, with values of approximately 150-180°C. Using a TESTO 350 M/XL gas analyzer, the measured values allow a complete analysis of the types of noxious eliminated. The results of experimental measurements show that the fluctuations obtained during the measurements are very small, of the order 2 mg/m³_N for each type of noxious eliminated, which indicates a very good regulation of the work process. The average values of the eliminated noxious substances, CO, NO_x, CO₂ indicates compliance with European environmental quality standards. The use of high-performance instalations, with a high degree of automation allows rigorous control over the different types of pollutants released into the atmosphere by the work installations from compound feed factories.

Keywords: *compound feeds, noxious substances, environment, control, automation.*

ECO-FRIENDLY METHOD FOR PRETREATMENT OF LIGNOCELLULOSIC TEXTILES

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Abstract

Natural fibres fabrics are subjected to a pretreatment process to remove cellulose attendants such as: pectin, hemicelluloses, waxes, etc. The world current trends for eco-friendly industrial procedure can be successfully applied also in textile industry. The aim of our research was to study the efficiency of an eco-friendly complexing agent (sodium citrate) and ultrasound energy in enzymatic pretreatment (bioscouring) of a 30% of hemp + 70% of cotton material. The treatment was carried out in an aqueous solution containing a commercial pectinases mixture (Beisol PRO), 2 g/L sodium citrate and 0.5% washing agent (Denimcol Wash RGN). The hydrolytic reaction was developed at 55⁰C, the liquid to fabric ratio being 20:1. In addition to the use of less environmentally aggressive chemicals, the proposed scouring treatment used lower reaction temperatures and shorter lead times compared to the classical method. Improvement of the process and better properties for treated materials were obtained by intensifying the effect of the enzyme mixture through the ultrasonic reaction bath at a frequency of 45 kHz. In order to determine the new properties of the bioscouring fabrics, weight loss, hydrophilicity, tensile strength, elongation at break, CIELAB colour system analysis of the dyed samples with alizarin and ruthenium red dyes were performed. The results showed that the eco-friendly method performed in the presence of sodium citrate and ultrasound was effective at a lower enzyme concentration and a shorter treatment time, thereby reducing the costs and the possibility of degradation of the treated material.

Keywords: *Bioscouring, eco-friendly complexing agent, hemp-cotton fabrics, commercial enzyme product, ultrasound.*

PREDICTION OF WATER CONDITIONS FOR MAIZE CULTIVATION ON THE CHERNOZEM SOIL UNTIL THE YEAR OF 2100

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Abstract

The aim of this paper is to estimate water conditions for maize cultivation on the chernozem soil in the area of Zemun (Autonomous Province of Vojvodina, Serbia) until the year of 2100. The study intends to evaluate future maize water requirements (ET_c) and irrigation requirements. To this end, the NMMB Regional Climate Model was used. The model provided the projections of the daily minimum and maximum air temperatures, as well as rainfall for the growing seasons of 1975-2000 and 2023-2100 for the area of Zemun. The projections of these parameters were based on the RCP8.5 scenario. Based on the projected temperature, the monthly values of reference evapotranspiration (ET_o) were calculated using the Hargreaves method. In addition to the plant and soil data, the obtained ET_o data served as input data in the FAO CROPWAT 8.0 crop model. The examined plant was maize, while the soil was chernozem as the dominant soil type in Vojvodina. The simulations of the CROPWAT 8.0 crop model show that water requirements in the first future period 2023-2048 will be similar to the ones in the reference period (1975-2000). Irrigation requirements are even expected to be by 9% lower than in the reference period. The simulations indicate that water conditions will deteriorate in the second future period (2049-2074). The deterioration will reach its maximum in the third future period (2075-2100). Thus, the simulations show that the end of the 21st century will witness the ET_c increase by 17% and the rise of irrigation requirements by as much as 73% in comparison with the reference period. It can be concluded that the simulations indicate the deterioration of the water conditions for maize cultivation on chernozem in the area of Zemun until the end of the 21st century.

Keywords: *maize, CROPWAT, climate changes, irrigation requirement.*

ENDANGERED FISH SPECIES IN THE DRINA AND ZAPADNA MORAVA RIVER BASINS (CENTRAL BALKAN REGION)

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Abstract

The Central Balkan region (western Serbia and eastern Bosnia and Herzegovina) is characterized by a well-developed hydrographic network. Watercourses in the region belong to the Drina River Basin (area 19570 km²) and the Zapadna Morava River Basin (15849 km²). Despite the generally favorable living conditions for fish survival, the qualitative and quantitative structure of the ichthyofauna of this area has deteriorated in recent decades. Apart from obvious pollution, reasons also include overfishing and various river course interventions, particularly the formation of mini hydroelectric power stations, which cause water reduction in mountain streams, thus drastically threatening the existing indigenous fish fauna. In the period 1990–2018, the authors investigated the ichthyofauna of this area using standard fishing equipment (gillnets of various mesh sizes and electrical generators). In addition to the authors' own research results, the available literature and sport fishermen's catch data were used. The results indicated that the most endangered fish species in the Drina River Basin were huchen (*Hucho hucho*), grayling (*Thymallus thymallus*), bullhead (*Cottus gobio*) and Black Sea salmon (*Salmo labrax*). The most endangered species in the Zapadna Morava River Basin were tench (*Tinca tinca*) and zingel (*Zingel zingel*), which fishing in the Republic of Serbia was totally prohibited in 2009. Conservation actions for endangered fish species include activities such as pollution reduction, construction of fish passage facilities at dams, limitation of catch landing and ban on building mini hydroelectric power stations.

Keywords: *ichthyofauna, vulnerability, water protection.*

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UTILISATION POSSIBILITIES OF BY-PRODUCTS FROM COFFEE PRODUCTION IN FOOD INDUSTRY

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Abstract

Often referred to as worlds' second most valuable commodity, coffee is produced in fifty countries and subsequently consumed worldwide generating a great amount of waste. Among their many other applications, this paper provides a survey of coffee by-products utilization in food industry. Coffee pulp is used to obtain volatile compounds and acetic acid by microbial activity. It can also be a source of anthocyanins, acting as natural colorants and bioactive ingredient. Recently, coffee pulp flour with high fiber (18%) and mineral (8%) content has been developed for application in confectionery and baked products. Various food additives (pectins, antioxidants and colors) can be obtained from mucilage, and even coffee honey was extracted from it. Husk is a source of citric acid and natural flavour. Silver skin has been used in combination with other ingredients in producing innovative coffee blends, bread, and biscuits, which had improved sensory and nutritional composition and reduced amount of hydroxymethylfurfural and acrylamide. Spent coffee grounds (SCG) has been used for obtaining a distilled beverage with coffee aroma and bioactive extract enriched in caffeine. Due to melanoidins content, it also exhibits an antimicrobial effect on some pathogens, such as *S. aureus* and *E. coli*. Being rich in dietary antioxidant fiber, SCG is incorporated in diverse food formulations with low glycemic and energetic value. A mixture of all coffee industry by-products is used as substrates for edible mushroom cultivation. Therefore, coffee waste, as an abundant natural material with low value, has a great potential of transferring into beneficial food products.

Keywords: *coffee, by-products, waste, food products.*

CONTENT OF POTASSIUM IN SOIL ON THE TERRITORY OF NIŠ TOWN MUNICIPALITIES IN SOUTHERN SERBIA

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Abstract

Potassium is considered to be one of the most significant biogenic elements which is essential for the plant growth and which has positive effects on plant's disease resistance. It is also beneficial for the root growth and improves drought resistance, maintains turgor, reduces the water loss and the respiration by preventing energy losses, enhances the translocation of sugars and starch. It belongs to the group of alkali metals and its natural reserves are large. However, the readily available forms of this element are commonly found in small quantities. Soluble potassium, i.e. soil solution potassium is the form most available to plants. It is present in the soluble salts of the soil solution as well as in the ionian solution which is balanced with the salts absorbed by the colloidal complex. This paper aims to examine the soil content of the readily available forms of potassium on the territory of Niš town municipalities (southern Serbia) in 2015. The total number of the collected samples was 307. The collected samples were examined by the AL-method in the laboratory of the Agricultural and Advisory Services in Niš. The obtained results were processed by the computer program IBM SPSS Statistic – 20 (trial version). The analysis proved that the soil in the examined region is rather rich in the readily available potassium. Almost 63% of the samples were classified as those containing high levels of potassium while only 2% of the total samples were classified as those with low levels of potassium.

Key words: *potassium, analysis, soil, Niš town municipalities.*

PHYTOBIOTICS – EFFECTS AND SIGNIFICANCE ON ANIMALS

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Abstract

Spices and herbal extracts are one of the oldest additives in the human diet. In recent years, herbal extracts have become increasingly important as additives in animal nutrition. Alternative growth stimulants, probiotics, prebiotics, organic acids, enzymes, as well as herbal additives with a certain stimulant effect and antimicrobial effect (phytobiotics) have increasingly been used in animals due to the ban on using antibiotics in animals. Phytobiotics are supplements of plant origin in animal feed and affect the stimulation of food consumption, act anti-inflammatory and immunostimulatory, and have the antimicrobial, antioxidant and anticancer effects. Essential oils are synthesized in most plant organs, deposited in secretory cells, cavities, the epidermis, or glandular hairs. They are produced and secreted from glandular trichomes, which are specialized secretory tissues on the surface of plant organs, especially flowers and leaves. They have an antibacterial effect due to their hydrophobicity, which helps them bind to the phospholipid layer of a cell membrane or inhibit bacterial enzymes. Essential oils also have effects on animals in confined spaces that are either calming or stimulating and show reductions in stressogenic effects. The objective of this paper is to point out these and other positive effects of the use of phytobiotics on different species of animals. Further research and studies are necessary to clarify the various nutritional aspects of phytobiotics because, even if additives are considered to be natural products, they should still be tested for possible adverse effects on animal health and for possible interactions with other nutrients.

Keywords: *Phytobiotics, probiotic, food, essential oils, animals.*

SOLID WASTE DISPOSAL DECISION MAKING AND DEVELOPMENT OF URBAN AND PERI-URBAN AGRICULTURE IN YAOUNDE, CAMEROON

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Abstract

While rates of collecting waste in the wetlands of Yaoundé are low, the biodegradable proportions of these wastes are high and could be reused by the urban and peri-urban agricultural sector. Low rates of collecting waste have induced waste management to be a growing problem. This paper aims at identifying factors that affect the choice of method of solid waste disposal by agricultural households and non-agricultural households in the lowland areas of Yaoundé, Cameroon. Data were analyzed using a multinomial logit model. The results showed that solid waste disposal among agricultural household was strongly influenced by infrastructural variables relative to the social variables. In reference to communal infrastructures, accessibility to the area of residence decreased the probability of choosing recycling as a waste management method for both farm households and non-farm households, while long distance rather increased the probability. The number of years in the neighborhood, agricultural experience and the distance from the communal containers influenced the waste management method either illegal dumping or recycling. From the results it was concluded that, transfer collecting stations for household waste should be built in or near the lowland areas to facilitate waste collection by municipal services on one hand, and farm households for their agricultural activities on the other hand.

Keywords: *Solid waste recycling, Multinomial Logit, farm households, Urban and peri-urban agriculture, Yaoundé.*

PRUNNING WASTE VALUATION AS SOURCE OF BIOFUELS AND BIOPRODUCTS

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Abstract

Climate change and its effects is a reality nowadays and proposing solutions for its mitigation is a pending task both for governments and also citizens. The most powerful alternative to mitigate climate change is to bet on renewable energy, using the Earth's resources to generate clean and sustainable energy. In this study, the use of the olive tree and grapevine pruning waste was evaluated, since they were important crops in Europe, due to area harvested of these crops (10.5 mill ha olive tree and more than 3.5 mill ha grapevine). Quality parameters of biomass samples of grapevine and olive pruning waste presented in the form of chips and pellets was carried out. Thus, ash content, lower and higher calorific value, and the content of different elements such as carbon, nitrogen or sulfur, among others, were determined according to the official methods published in UNE-EN ISO 16948, 14918 and 18122. Results showed that the grapevine pellet (I3) and the olive tree chip (A2) could be considered as legal biofuels according to the UNE-EN ISO 17225-2: 2014 solid biofuel regulations. No statistical differences were found between olive tree and grapevine wastes in relation to the calorific value. However, grapevine waste showed a higher content in ashes (2.7% compared to the vine with 3.8%). Pellets showed a higher calorific value (4,549.5 Kcal / kg) than the chips (4,465.8 Kcal / kg). In addition, it was determined that the ash content of waste coming from shape pruning was lower than that from annual pruning.

Keywords: *Olive tree, Grapevine, Pellet, Biofuel, Wood chips.*

EFFORTS TO USE SOFT PESTICIDES FOR THE CONTROL OF INSECT PESTS AS CONTRIBUTION TOWARDS GREEN CHEMISTRY

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Abstract

In the last decades during the post-war period, the agriculture has developed towards methods that are more intensive. Among these is increased use of agrochemicals. In the Sudan Gezira, as an example, cotton spraying started as early as season 1945/46 when only 1% of the cotton area was sprayed once. By 1978/79 the problem caused by the cotton insect pests, particularly the cotton whitefly (*Bemisia tabaci*) flared up. The number of sprays per season went up, reaching 9.25 sprays in season 1978/79, which might be attributed partly to the rapid resurgence of insects' pests as a result of the use of non-selective insecticides, which badly affected the natural enemies of these pests. The joint use of natural enemies and selective pesticides might attribute to combat this problem. Studying the side effects of pesticides is of prime importance to save natural population and encourage their role as biological control agents. This paper discuss the various methods which can be used to study the side effects on natural enemies and the results of some studies carried on the side effects of some insecticides on natural enemies both at small and large scale levels in Sudan. The study includes testing the side effects of some insecticides and their impact on bio-safety (Talstar, Polo, Metasystox, Marshal and the mixture Reldan + Endosulfan) on two Predators at small-scale level at the Gezira Research Farm, Wad medani. The Impact of Polo (diafenthiuron) on natural enemies in the cotton-based ecosystem of the Gezira Scheme (Large Scale) was tested in the Study. The results indicated that Polo was relatively safe both at small scale and large-scale level to the natural enemies observed during the study. This study can be considered as the beginning of regional testing program in Africa with collaboration of international organization interested on conserving bio-agent.

Keywords: *Cotton, Sudan, Biodiversity, insecticides, side effects.*

ROOTS OF THE XEROPHYTE *PANICUM TURGIDUM* HOST, A COHORT OF RADIORESISTANT MICROORGANISMS

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Abstract

Ionizing-radiation (IR)-resistant prokaryotes are also desiccation tolerant as desiccation tolerance could be a consequence of adaptation to IR resistance — radiation adaptation hypothesis. Therefore, xerophytes are pertinent targets to explore for new IR-resistant microorganisms with potential biotechnological applications. The phylogenetic diversity of prokaryotic communities exposed to arid conditions associated with roots of *Panicum turgidum* was evaluated with a combination of cultural and metataxonomic approaches. Based on traditional culture-based techniques, 32 isolates from irradiated roots were identified as belonging to Actinobacteria, Bacteroidetes, Firmicutes, and Proteobacteria phyla. Four actinobacterial strains were demonstrated to be radioresistant, which were *Kocuria rhizophila* PT10 (2.9 kGy), *Micrococcus* sp. PT11 (4.4 kGy), *Microbacterium* sp. PT8 (4.8 kGy), and *Promicromonospora panicae* PT9 (2.6 kGy). Besides, metataxonomic analyses of the diversity of radioresistant microorganisms associated with irradiated roots revealed a marked dominance of Actinobacteria (46.62%) and Proteobacteria (31.51%) compared to Bacteroidetes (4.59%) and Firmicutes (3.19%) groups. However, gamma irradiation not only changed the structure of bacterial communities, but also affected their functional properties. The analyses of metabolic profiles indicated the presence of several pathways related to adaptation to oxidative stress, such as DNA repair, secondary metabolites synthesis, nitrogen fixation, reactive oxygen species disposal enzymes, etc. This investigation represents the first report that examines the diversity of IR-resistant microorganisms associated with roots of *P. turgidum* and their metabolic profiles using gamma-rays exposure pre-selection.

Keywords: Culture approach, Desiccation, Radioresistant, Metabolic profiles, Metataxonomic, *Panicum turgidum*.

EFFECTS OF TEMPERATURE FLUCTUATIONS ON POULTRY HOUSING'S ENERGY DEMANDS AND GLOBAL WARMING: CASE OF LAKES REGION IN TURKEY

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Abstract

Depending on the heating and cooling load of agricultural structures, energy analysis, heating and cooling performance, is based on outside climate data. Effective use of energy in agriculture and other structures has gained importance due to global warming and regional or local climate change. For this purpose, Burdur and Isparta provinces located in Lakes Region of Turkey were selected as the study area. In the study, daily maximum and minimum temperature values in the period 1950-2019 obtained from meteorological stations in these provinces were used. Regression analysis was made between calculated HDD and HDDNs with suggested temperatures for broiler chickens. The statistical suitability of the developed equations were examined with correlation, F and probability tests. In addition, the changes in the HDD and HDDNs, which were calculated according to the heating energy estimates, the external and internal temperature values related to global warming, were examined. As a result, regression equations with high correlation (0,993-0,999) between calculated HDD and HDDNs were developed for indoor and outdoor poultry housing at temperatures recommended for broiler chickens. In addition, as a result of global warming in the Lakes Region, it was determined that there were changes between 0.024 and 0.03233°C/year at maximum temperatures and -0.0097 and -0.01421 °C/year at minimum temperatures. It is determined that the HDD values calculated due to global warming used in between 34.6-78.1% more energy than the HDD values calculated in outdoor weather conditions. It is concluded that the developed equations will help in the planning and projecting stages of the heating systems in broiler poultry houses existing or to be made in the region.

Keywords: *Lake, Global warming, Heating, Temperature.*

HYDRO-METEOROLOGICAL MODELING OF ANNUAL LAKE WATER LEVELS AND LAKE WATER VOLUMES: CASE OF EĞIRDİR LAKE IN TURKEY

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Abstract

Because of global warming, climate change, rapid urbanization and industrialization, population growth, unplanned and excessive water use significantly affect the water levels and water volumes of lakes from fresh water sources. For this purpose, the Eğirdir lake in the tectonic structure, which has a basin area of 3445.6 km² within the boundaries of Isparta province in Turkey, was chosen. In the study, the lake water level measurement station values of Eğirdir lake between 1988-2018 and the long-term temperature, precipitation, relative humidity, wind speed values of the Egirdir meteorology station were used as materials. In order to develop the equations between Egirdir lake water level and water volume and hydro-meteorological variables, respectively, correlation analysis, autocorrelation analysis, best sub-equation models analysis, variance analysis (ANOVA) and multiple regression analysis were applied. F, correlation (r) and probability (p) tests were performed by examining the statistical suitability at 5% significance level. As a result, it was determined that multiple linear regression equation (0,991) and multiple non-linear regression equation (0,991) were suitable for future water level and water volume estimations of Egirdir lake, respectively. From the developed equations, prospective lake water level and water volume estimations can be made for the state or local organizations that make up Eğirdir lake users. In addition, it has been concluded that planning and project studies can help the hydrological sustainable management of Eğirdir lake.

Keywords: *Eğirdir Lake, Water level, Water volume.*

EFFECT OF COCOA BEAN HULLS ON SENSORY PROPERTIES OF POUND CAKES AS FAT AND FLOUR REPLACER

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Abstract

The effects of raw and leached cocoa bean hulls were investigated as flour and fat replacer in pound cakes. While fat substitutions were applied for raw (RCBH) and leached (LCBH) grinded cacao bean hulls in the ratios of 30/70 (30%), 40/60 (40%) and 50/50 (50%), flour substitutions were also applied for 20/80 (20%), 30/70 (30%) and 40/60 (40%), respectively. Descriptive sensory analysis of raw and leached cocoa bean hullreplacing fat and flour substituted cakes were evaluated and compared by principal component analysis. In both fat and flour substituted cakes, crumb brownness increased as the amount of cocoa bean hulls increased. Crumb brownness of flour substituted cakes produced with LCBH was higher than those produced with RCBH, while fat substituted cakes produced with LCBH was found to be lower than those produced with RCBH. Cell uniformity and bitter taste of both fat and flour substituted cakes decreased when leached cocoa bean hulls were used. For fat substituted cakes, oiliness was perceived higher in RCBH cakes than LCBH cakes. Hardness (hand) was also higher in fat-substituted LCBH cakes than in RCBH cakes, while lower in flour substituted LCBH cakes than in RCBH cakes. According to the principal component analysis, flour substituted RCBHcakes were separated from LCBH cakes in terms of sweetness, adhesiveness, cell uniformity, hardness (hand), cacao taste and bitterness. Fat substituted RCBH cakes were separated from LCBH cakes in terms of crumb brownness, cacao taste, bitterness, moistness, oiliness, cell uniformity properties. In conclusion, cocoa bean hulls as raw and leached types effected on descriptive sensorial properties. Those properties also showed difference in terms of substitution type. RCBH cakes included in more advantages based on descriptive sensory analysis for flour and fat substituted cakes.

Keywords: *Cocoa bean hulls, Fat substituted cakes, Flour substituted cakes, Descriptive sensory analysis, Principal component analysis.*

DETERMINATION OF POTENTIAL ENERGY VALUES FROM SOME CEREAL RESIDUES: THE CASE OF ARDAHAN PROVINCE IN TURKEY

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Abstract

In this study, it is aimed to calculate the potential biogas energy amount that can be obtained from some cereals grown on the basis of districts of Ardahan province in Turkey. The results obtained were compared with the relevant literature information and necessary calculations were made. In the study, some cereals such as wheat, rye and oat where grown in Ardahan province were evaluated. It has been determined that an annual energy of 205923.22 MJ can be obtained from usable agricultural wastes by taking into consideration the data of TUIK in 2004-2019 period. It has been determined that 106070.24 MJ of energy, which constitutes 51.51% of the energy that can be obtained from cereal residues, can only be obtained from barley. The energy of 15842.02 MJ, which constitutes 7.69%, has been obtained from rye. It is thought that energy production activities based on agricultural waste may come to the fore by evaluating some cereal residues such as barley, wheat, rye and oats grown in Ardahan province.

Keywords: *Ardahan, Cereal, Biogas energy, Barley, Wheat.*

DETERMINATION OF POTENTIAL OF BIOGAS ENERGY VALUE FROM ANIMAL MANURE: CASE OF ARDAHAN PROVINCE IN TURKEY

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Abstract

In this study, biogas potential that can be obtained from animal wastes in Ardahan province was calculated. The results obtained were compared with the relevant literature information and necessary calculations were made. In the research, calculations were made by using the data of Ardahan in the period 2015-2019. For this purpose, the amount of wet manure and potential biogas energy that can be obtained depending on the number of dairy cattle, meat beef, horse, donkey-mule, sheep, goat, broiler, egg chicken, turkey, goose and duck were calculated. These values were calculated on a yearly and district basis. It was calculated that the amount of wet manure that could be obtained from animal wastes in Ardahan province was 21710.45 million kg and the potential biogas energy available was 293.92 million MJ. It was determined that the electricity and natural gas equivalent that could be obtained from this energy potential could meet the needs of the province. Also, it was determined that these values could meet 0.10% of electricity consumed in our country and 0.13% of natural gas. It could be seen that the total amount of biogas that could be obtained was equivalent to approximately 1381.44 million kWh of electrical energy or 253.14 million m³ of natural gas energy. It is believed that energy production activities based on agricultural raw materials may come to the fore by using these wastes to be produced for energy production. Therefore, it is no doubt that they will become a valuable resource when animal waste is properly managed and stored.

Keywords: *Ardahan, Animal manure, Biogas energy, Cattle, Sheep.*

USING OF DATA MINING TECHNIQUES IN AGRICULTURAL APPLICATIONS

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Abstract

Data mining is the process of discovering interesting patterns from huge amounts of data, as a knowledge discovery process. It typically includes cleaning, data integration, selection, transformation, pattern discovery, pattern evaluation, and knowledge presentation of data. It can be applied on different kind of data as long as the data are useful for specified aim of any study, such as a database, warehouse data, and advanced data types. Data mining has incorporated technologies from many other domains, these include statistics, machine learning, database, data warehouse systems and information retrieval. The aim of this study is use of data mining in various fields, especially in agricultural sciences. It is widely applied to agricultural problems and it is solved by using different methods of data analysis. Data mining technique can be used for estimating and predicting weather forecasts, soil water parameters, marketing etc. The interdisciplinary nature of data mining research and development contributes significantly to the success of data mining and its extensive applications.

Keywords: *Data mining, database, data warehouse, pattern.*

TRADITIONAL RANGELAND RESOURCE UTILIZATION PRACTICES AND PASTORALISTS' PERCEPTIONS ON LAND DEGRADATION IN MADDAWALABU DISTRICT, SOUTH-EAST ETHIOPIA

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Abstract

A study was conducted to examine rangeland resource utilization practices of pastoralists and rangeland degradation in Madda Walabu district, south-east Ethiopia. A single-visit survey method was used to gather data through a structured questioner (130 households), group discussions and direct observations. Free grazing of communal land (100%), use of enclosures (89%), division of herds based on species and class of animal (59%), migration (79%) and seasonal assessments of the condition of rangeland were the basic traditional rangeland management practices. About 91% of pastoralists indicated that the condition of their rangelands was poor. The most dominant use for woody plants was for construction (91%), followed by browse (68%) and medicinal purposes (25%). More than 86% of the respondents considered that their grazing lands now carried more bushes and shrubs than they did 30 years ago. Feed and water shortages and drought were identified as current challenges for pastoralists, with migration the main coping strategy, in spite of the hardships it entailed. Rejuvenating the existing rangelands requires the development of a range-land management strategy involving pastoralists and other stakeholders, with all participants fully committed to a successful outcome. A reduction in livestock numbers must be an essential component of any future strategy.

Keywords: *Pastoral perception, Rangeland degradation, Resource utilization, South-east Ethiopia.*

CRITICAL THRESHOLD TEMPERATURES IN DECLINING GRAIN YIELD OF DURUM WHEAT DURING CROP DEVELOPMENT STAGES IN A SEMI-ARID REGION

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Abstract

This study was aimed at determining critical threshold mean and maximum temperatures in the declining grain yield of durum wheat according to the initial stage (sowing and emergency), crop development stage (vernalization and tillering), mid-season (heading, anthesis and grain filling) and last season (maturity) for consumptive water use. The study sites included Cizre, Kilis, Siverek and Gaziantep in the Southeastern Anatolia Region of Turkey. Well-processed and quality-checked climatic and yield data during the period of available years (2009-2018) in the study sites were evaluated. All evaluations were performed using nonlinear model (quadratic, polynomial). The highest negative effect ($R^2=0.86^*$) of maximum temperatures was in crop development stage in Siverek because this stage covers the vernalization period as well. The effects of the maximum temperatures were significantly different considering latitudes and altitudes. The nonlinear model was, thus, used to estimate the grain yield depending on the critical maximum and mean temperature derived from the regression equation to describe the level at which the grain yield starts to decline. The critical maximum temperatures (threshold values declining yield) were computed as given: stages; crop development stage, mid-season and last season, Gaziantep: 18.9, 24.2 and 34.0 °C; Siverek: 19.2, 25.8 and 36.1 °C; Kilis: 21.9, 27.5 and 34.1 °C; and Cizre: 25.2, 29.7 and 37.3 °C, respectively. In addition, it was determined that the yield might change about 2.5% for every 1 °C increase in the growth period considering the daily average temperature based on the daily mean temperature of 12.4 °C for all locations.

Keywords: *Climate change, critical maximum temperature, crop development stage, durum wheat, growing degree day.*

IMPACT OF AGRICULTURAL RUNOFF OF PHOSPHORUS IN WATER QUALITY: IMPLICATION OF AGRO-ECOSYSTEMS MANAGEMENT

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Abstract

Phosphorus (P) loss from agricultural fields is a major cause of water quality problem around the world. Relative impacts of different sources of P including agricultural, geologic, and recycling/remobilization are poorly constrained mainly due to methodological constraints. We analyze dissolved, suspended particulate matter, and sediment-bound P in the surface water, porewater, and sediment to develop the source-sink relationship of P in an ecosystem. To achieve this goal, we merge advanced analytical techniques including stable isotopes [phosphate oxygen ($\delta^{18}\text{O}_\text{p}$), nitrogen ($\delta^{15}\text{N}$), and carbon ($\delta^{13}\text{C}$)], spectroscopic methods [1-D (^1H , and ^{31}P) and 2-D NMR, Raman, and IR] and a suite of mineralogical (XRD), microscopic (SEM and TEM) and elemental analyses. Our key findings point towards the dominant process of organic P remineralization and cycling, an active transformation of settling particulate matter in the water column, and a higher rate of degradation of recalcitrant organic P. New insights gained from these findings on the pathway and extent of biological cycling are expected to be useful to address water quality issues in the agricultural runoff dominated coastal waters worldwide.

Key words: *Phosphorus, agricultural fields.*

THE RESPONSE OF SOIL NEMATODE CAENORHABDITIS ELEGANS ON THE SEWAGE SLUDGE DERIVED MICROPOLLUTANTS

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Abstract

Sewage sludge application to soil is of great interest, due to required organic matter and the wide spectra of nutrients it provides. However, the presence of unpredictable content of emerging contaminants may turn this valuable raw material into a hazardous substance. In this study, three selected sewage sludges derived micropollutants from different origins, that is, one each under persistent organic pollutants (POPs), pharmaceuticals and personal care products (PPCPs), were considered. The effect of each micropollutant on the feeding activity of free-living soil nematode *Caenorhabditis elegans* was analyzed. The analysis was performed in model soil solution using a larval feeding inhibition assay. The results showed no significant effects from selected POP—2,2',4,4',5-pentabromodiphenyl ether and pharmaceutical—chlortetracycline on the feeding activity of tested nematodes. On the contrary, feeding activity was inhibited by PPCP—galaxolide (HHCB) with an effective concentration of 12.2 ± 2.2 mg.l⁻¹. The calculated risk quotient for galaxolide (RQ = 0.14) demonstrated a medium ecological risk to the nematodes. Based on our findings, concentrations of micropollutants in sewage sludge treated soil pose negligible risk to feeding activity of soil nematode. However, the potential impact of musk compounds on free-living soil biota requires detailed evaluation in further research.

Keywords: Sewage sludge, Galaxolide, Chlortetracycline, BDE-99, Nematode.

THE DEPOLLUTION OF THE WHEY REJECTED BY THE CHEESE INDUSTRIES USING CHEMICAL, PHYSICAL AND MICROBIOLOGICAL METHODS

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Abstract

In most developing countries, the cheese industry releases thousands of liters of whey a day into the wild. This whey is considered a waste. It has great biological value but it is also very polluting and harmful to the environment. The aim of this study is to evaluate several methods of depolluting whey on a laboratory scale and extrapolate the results on a large scale: the industrial scale. First, the physico-chemical characterization of the whey harvested from *GIPLAIT Tlemcen* (Algeria) was carried out. Then, different treatments were realized on our samples: physical, chemical and microbiological. The measurement of BOD5 (via Oxitop) of the different samples was made before and after treatment in order to evaluate the depollution performance. The results showed that the deproteinization and de-sugaring by microbiological culture had the highest depollution efficiency, a decrease of the BOD5 that reached 29%. These results can be obtained by ultrafiltration, nanofiltration, reverse osmosis and bioreactor systems on an industrial scale. As a conclusion, the depollution of the whey goes through its de-sugaring. The best and easiest applicable methods of depollution/valorization are the drying/atomization and the ultrafiltration/nanofiltration.

Key words: *Whey, Depollution, BOD5.*

CLIMATE CHANGES AND FIRES IN BOSNIA AND HERZEGOVINA

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Abstract

Like most countries in the world, Bosnia and Herzegovina (BiH) is facing the consequences of climate change. There are catastrophic floods on the one hand and extreme droughts on the other, especially during the last decade. In addition, there is an increasing number of fires, especially in the Herzegovina region. Weather and climate, vegetation condition and composition, and human factors play an essential role in fire regimes. Higher average temperatures and less precipitation during the summer increase the risk of fire. As a main component of risk, wildfire danger is linked with the factors, including weather and climate, which can worsen either the likelihood of ignition, or the behaviour of the fire once ignited. Considering climate change scenarios, it is very likely that the damage they cause will be even greater in the future.

Keywords: *Climate changes, fires, Bosnia and Herzegovina.*

FOSTERING GREEN ECONOMY THROUGH NEW FINANCIAL INSTRUMENTS IN CENTRAL BANKS' PORTFOLIOS

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Abstract

The green economy implies the use of renewable energy from biomass, solar panels, wind power plants and recycled waste, while providing the environmental protection, human well-being and sustainable economic progress. As with other investments, the important question is how to find sufficient sources of funds and get investors interested in these projects. Global green bond issuance started along with the increasing need for financing green businesses and technologies, resolving climate change issues and financing through efficient emission of green securities and trading on markets. The proceeds of these bonds are explicitly used to finance new or existing green projects. This paper examines the concept and evolving of green bonds with emphasis on the new role of central banks in greening financial systems and its impact towards a green economy. The green bond market dates back to 2007, with launching the World Bank Green Bonds programme in 2007 and the Climate Awareness Bonds by the European Investment Bank (EIB) in 2008 for financing renewable energy and energy efficiency projects. The significance of making bond between sustainable economic development and environmental issues is evident through the rapid growth of these green instruments. The objective of this research was to identify new types of financial instruments intended to improve ecological projects, as well as to compare effects of green bonds utilization in different countries and by different institutions. The results show the improvement of the financial market and investor profits, while there is simultaneously significant growth of green projects pointing to the benefits of using this new form of financial instrument in promoting the green economy.

Keywords: *green economy, sustainable and responsible investment, central banks, green bonds.*

GLOBAL LARGE-SCALE LAND INVESTMENT IN AFRICA: IMPLICATIONS FOR THE ENVIRONMENT

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Abstract

The attainment of sustainable development goals (SDGs) in Africa will depend in part on its endowment, productivity and management of the land resource. Thus, due to the multipurpose usage of the land, there is more interest in its acquisition and usage, which often lead to competition among investors. More so, the intensive use of land for economic activities often impacts on the environment. This has implication for the target countries' sustainable development. It is on this basis that this study investigates the effects of large-scale land investments on the environment. The study adopts the sample selection model to find that at the decision to invest, there is the tendency the environment gets more deplorable while the foreign investors sustainably use the land and this is not the case for domestic investors. At the actual large-scale land investment level, the foreign large-scale land investment has adverse effects on the environment, but they maintain sustainable use of land, while the domestic large-scale investment negatively impacts on both the environment and the sustainable land use. Climate change impeded the availability of large-scale land. Thus, although the large-scale land investments could mitigate the challenges of national food insecurity, there should be intense efforts by the government to continuously monitor and regulate the activities of these investors to conform with global environmental best practices.

Keywords: *Environment, Land Investments, Large-scale, Gravity model, Africa.*

SOIL SALINITY MAPPING USING LANDSAT 8 OLI DATA AND REGRESSION MODELING IN THE GREAT HUNGARIAN PLAIN

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Abstract

As one of the widespread degradation forms in the land, soil salinization represents the accumulation of salts in the surface when precipitation exceeds evaporation. The aim of this study is to map soil salinity using multispectral data combined with four regression models; Multiple Linear Regression (MLR), Partial Least Squares Regression (PLSR), Ridge Regression (RR), and Feedforward Artificial Neural Network (ANN). Soil sampling results collected from the Great Hungarian Plain (GHP) were provided by the Research Institute for Soil Sciences and Agricultural Chemistry (RISSAC). The performance of four models was evaluated and compared using three statistical metrics, the root-mean-square error (RMSE), the mean square error (MSE), and the Min-Max accuracy. The results proved that the RR model had an optimal prediction performance ($MSE_{\text{training}} = 0.0008182678$, $MSE_{\text{test}} = 0.002412867$, $RMSE = 0.02860538$, and $\text{Min-Max accuracy} = 63,51\%$) and it was selected for mapping soil salinity in the study area. The application of RR model on spectral indices, Principal Component Analysis (PCA), and Land Surface Temperature (LST) derived from a Landsat 8 OLI image is a reasonably reliable method for soil salinity assessment at local scales. Around 99% of the soils in the study area were non-saline, and less than 1% were low saline. The map can be used to give an overview of soil salinity levels in the study area, and to assess the efficiency of management strategies in the irrigated areas. An increase in the sampling density would be recommended to strongly confirm our approach on the regional scale. Further research will be done to reduce spectral noise in the image, to minimize the prediction error, and to improve the accuracy of the map, with taking into consideration the environmental factors effect.

Keywords: *Soil Salinity, Landsat, Regression Modeling, Remote Sensing, The Great Hungarian Plain.*

ENHANCING ROAD SAFETY THROUGH ROAD LANDSCAPE DESIGN THE CASE OF METN EL SARIH HIGHWAY- LEBANON

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Abstract

Lebanon is the 86th country in car crashes worldwide according to the World Health Organization (2017) and the Service of Technical Studies for Roads and Highways showed that 74% of the driver's failure comes from wrong information sampling and treatment leading to road accidents. Knowing that the road is not independent of its surroundings and that it should manipulate the legibility and the visibility for the user to control his behavior and speed, a study was conducted along Metn El Sarih highway (12 km) because of its road landscape conditions related to the highest car crash rate and low level of safety in the North Metn's area, going from its urban cities to the mountainous areas. Therefore, surveys were conducted in order to understand the users' perception of the road, their legibility to its safety and level of visibility and access. Besides, aerial maps from different areas of the surrounding municipalities were studied along the way. As a result, 5 spots were chosen for a road safety intervention because of their bad visibility, inconvenient road conditions and dangerous turns. Thus, the cuts and fills of these spots were considered to study the angle of visibility and its weaknesses for a suitable intervention. The results were implemented on detailed maps, sections and sketches to demonstrate the road landscape safety design, accompanied with comparative studies of the safety's value, by adding the convenient greenery depending on its height, texture, shape and color, applying urban furniture and amenities in seated public spaces as well as observatories with parking spots facing landscape views serving as distractions. This road landscape design increased the visibility and legibility required to reach safe road landscape standards.

Keywords: *Landscape, Road Landscape, Road Safety, Road Landscape Design, Lebanon.*

THE LANDSCAPE AND VISUAL IMPACTS ASSESSMENT OF NORTH METN, LEBANON

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Abstract

North Metn is distinguished for its transformation throughout a short period of time, especially amongst its landscape elements, landscape characters and visual impacts from the coastal to its mountainous landscape. One methodology was proven to be efficient to this matter of study defining the Landscape and visual impact assessments LVIA “as a mechanism by which the landscape can be assessed against its capacity to accommodate change”. Therefore, an assessment of the potential landscape and visual impacts of North Metn development was conducted in line with LVIA Guidelines. Its objective is to determine the existing landscape elements and visual quality and evaluate their impact. Thus, 82 viewpoints distributed from the coastal to the mountainous landscape were studied throughout this overpopulated area of Lebanon, along with on-site observations, including site borders, primary roadways, significant valuable sites and public places. The study was divided into two parts. First, the Landscape Characters that were assessed by Landscape Quality, Landscape Value, Character Sensitivity, Landscape Visual Sensitivity and Magnitude and Significance of change. Second, the Visual Assessment which took into consideration the Visual receptor Sensitivity, the Magnitude and duration of change, the Visual intrusions and the change in the quality of the view compared to others. The results of both parts were therefore analyzed in order to classify the Significance of Visual Effects of the studied region as Major, Moderate, Moderate/Major, Minor or Moderate/Minor. Once the results were analyzed, North Metn’s Significance of Visual Effects was ranked. In total, 65.85% of the district’s landscape is between Major, Major/Moderate and Moderate ratings highlighting essential issues in the impact of change needed to be foreseen in the future landscape management.

Keywords: *Landscape character, Landscape and Visual impacts, North Metn, Significance and magnitude of change, Visual Assessment.*

CONSTRUCTION MATERIALS ASSESSMENT TOWARDS SUSTAINABLE EXPANSION OF THE LEBANESE CITIES

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Abstract

Global annual resource use reached nearly 90 billion metric tons in 2017 and may even double by 2050. Since materials' extraction cause $\pm 8\%$ of energy consumption worldwide and will increase due to resource scarcity, scientists search for equivalent sustainable materials. To decrease the materials' extraction and its negative effects, e.g. landscape degradation and ecosystem pollution, recycled and renewed materials are considered sustainable alternatives to decrease energy consumption. Thus, all countries including our case, a Mediterranean country importing most of its construction materials, should start exploiting locally available sustainable materials to address various environmental, social, and economic problems. Besides concrete, which is regularly used in Lebanon, Green Councils recommend the integration of many sustainable alternatives, e.g. straw bales, bamboo, recycled plastic, wood, rammed earth, ferrock and timbercrete. In this research, we analyze the potential of development for each alternative and its advantage to the Lebanese Community, with a focus on recycled plastic and chicken feathers due to their high availability in the country. After conducting interviews with sustainability specialists, the recommendations are to improve the concrete sustainability index since it is the most used construction material. Earlier studies have shown that concrete mixed with up to 3% chicken feathers makes it more sustainable. Recycled Plastic may be used alone or as an additive in concrete mixes. As a conclusion, recycled plastic construction materials and chicken feathers as sustainable additives to concrete mixes present the highest potential to be developed locally for their integration, and their immediate effect in limiting the fast expansion of dumping areas in Lebanon.

Keywords: *Sustainable materials, construction, environment, sustainability, Lebanese industry.*

ECONOMIC VALUATION OF SURFACE IRRIGATION WATER: SHIRE VALLEY, SOUTHERN MALAWI

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Abstract

Economic valuation of surface irrigation water and the factors that determine willingness to pay for such resource for sustainable purposes is not clearly defined in Malawi. This paper evaluated economic value of surface water used in irrigation and identified factors influencing farmers' decision to participate in water markets for rice and sugarcane production in Upper Shire Valley of Southern Malawi. A cross-sectional data from 310 households involved in irrigation activities was used. General Algebraic Modelling System (GAMS) was employed to determine the economic value of surface water. Craggit Double Hurdle Model and Range-WTP procedure was employed to determine factors influencing farmers' decision to participate and pay for surface water solicit the social value of the surface water. The results revealed an economic value of 480.77 Malawi Kwacha¹ (MK)/m³ for surface water in the valley, but specifically pointed out that surface water value for rice and sugarcane production was MK 512.96/m³ and MK 448.58/m³ respectively. Households irrigating rice and sugarcane revealed a willingness to pay for water at MK 1.67/m³ and MK 2.87/m³ respectively. Farming as a livelihood, plot status, crop type and market prices are reported to be influencing household participation in the water market. The study recommends that: (i) Farmers must always be informed of the economic value of irrigation water and be prepared to pay for it; and (ii) The allocated land should have a well-defined period of access and crop types to be grown in the valley should be of high economic value.

Key Words: *Economic valuation, Craggit Double Hurdle Model, Irrigation water, Sugarcane, Rice.*

¹ 1US\$=MK720.12 www.exchange-rates.org. Accessed on 17th April, 2019

IN VITRO EFFECT OF HERBICIDES ON PHOSPHATE SOLUBILIZING BACTERIA: CASE OF GLYPHOSATE AND PARAQUAT

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Abstract

Phosphate solubilization bacteria play a pivotal role in making an available solubilized fraction of various phosphate minerals in soils to growing plants. Phosphate solubilization bacteria are a phenomenon that makes biological fertilization possible for sustainable agriculture without return to the chemical fertilization. Intensive farming, which is based on the production in quantity, calls for the pesticides used to reinforce this technical management system without taking in consideration the health risks associated with these practices. Pesticide use becomes with time in our day's one the fastest solution for farmers to solve problems related to intensive agriculture. Our study is mounted intending to show problems through pesticide use on Phosphate solubilization bacteria despite their use at doses recommended by the responsible authorities on the homologation of these pesticides. This study was conducted to assess the in vitro effect of glyphosate and paraquat on inorganic phosphate solubilizing bacteria. Two different recommended doses of commercial paraquat in Morocco (2g/L and 4g/L) and two different recommended doses of commercial glyphosate in Morocco (5.4g/L and 10.8 g/L) on two selected phosphate solubilizing bacteria (*Serratia rubidaea* and *Pantoea agglomerans*) were tested in laboratory condition. Our study showed a negative effect on phosphate solubilization by *Pantoea agglomerans* and *Serratia rubidaea* in the presence of the both pesticides. In addition, comparing two pesticides effects on tricalcium phosphate (TCP) solubilization, the paraquat affected TCP solubilization more than the glyphosate.

Keywords: *Phosphorus, Glyphosate, Paraquat, Phosphate solubilization bacteria, Morocco.*

TOWARD BETTER PREPARADNESS OF MEDITERRANEAN AGRO-HYDROLOGICAL SYSTEMS TO FUTURE CLIMATE CHANGE-INDUCED DROUGHTS, STUDY CASE OF BOUREGREG WATERSHED (MOROCCO)

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Abstract

Globally, the Mediterranean region is considered among the most vulnerable regions to climate change impacts. This situation puts both agricultural and hydrological systems in this region at high risks. In order to improve the preparedness of both agricultural and hydrological systems to future climate change-induced phenomenon, such as drought, predictive analysis of their vulnerability is crucial. In this study, a hybrid modeling approach was built to understand the response of major crops and streamflow in a Mediterranean watershed to 2085-2100' droughts. The study watershed is Bouregreg catchment (9656 km²) in Morocco. To achieve this objective, the agro-hydrological model SWAT (Soil and Water Assessment Tool), the drought indices calculator DrinC© and the Indicator of Hydrologic Alteration program (IHA) were forced with climate data of two emissions scenarios (RCP4.5 and RCP8.5) from a downscaled Global Circulation Model. Several drought events, with different intensities across sub-basins, have been identified in the 2085-2100 period under both RCPs. Flow alteration has been estimated at the study watershed for the future simulation period. Crops wise, significant decreases of wheat productivity (up to -65%) were simulated during the future extremely dry growing seasons. Drought assessment at local scale needs reliable approaches capturing both local landscape processes (such as the local cropping patterns) and the watershed-scale hydrological responses. The adopted methodology in this study offers a comprehensive framework by taking benefit of the physical distribution feature of SWAT model and the statistical representation of different drought indices to forecast future droughts and their spatial extent within Bouregreg watershed. The adopted approach could be used in other watersheds with similar context and challenges.

Keywords: *Drought impact, agro-hydrological system, Bouregreg watershed, low flow, crop yield, SWAT, SPI.*

THE CHOICE OF CLIMATE CHANGE ADAPTATION STRATEGIES PRACTICED BY CASSAVA-BASED FARMERS IN SOUTHERN NIGERIA

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Abstract

The study on choice of climate change adaptation strategies practiced by cassava-based farmers was conducted in Southern Nigeria. The following specific objectives were achieved: to ascertain the perceived effects of climate change in the study area and to determine factors influencing the choice of using climate change adaptation strategies by cassava-based farmers in the study area. Data were obtained through the administration of questionnaire to 300 randomly sampled cassava-based farmers in the study area. Data were analyzed using descriptive statistics such as mean, frequencies, percentages and inferential statistics such as Multinomial Logit Regression technique. The result revealed that farmers perceived increase in flood incidence (91.33%), drought (90.67%), high incidence of pests and diseases (55%) and low yield (50%) as the effects of climate change in the study area. Also, from the results, 58% of the farmers chose not to employ the use of climate change adaptation strategies while only 42% decided to choose using climate change adaptation options in the study area. The result also showed that age of the farmer, farming experience, gender, marital status, level of education, household size, access to credit, access to agricultural extension services and membership of association were the factors influencing the choice climate change adaptation strategies used by the farmers. The study concluded that socio-economic attributes of the farmers affected their choice of climate change adaptation strategies. Policy should be targeted at designing climate change adaptation technology to farmers as well as providing the enabling environment that would encourage them to employ it.

Keywords: *Choice, Climate Change, Adaptation Strategies, Cassava-based Farmers.*

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INFLUENCE OF CONTROLLED GRAZING OF AUTOCHTHONOUS EQUINES AND RUMINANTS ON PRESERVATION OF THE HIGH GRASSLAND IN STARA PLANINA NATURE PARK, SERBIA

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Abstract

Conservation of animal genetic resources, rural revitalization and agrobiodiversity preservation has been promoted in Serbia for several decades. At the same time the area of protected nature sites has been also increasing, especially in the mountain region of the country. Unfortunately, the natural high mountain grassland has been in the process of succession due to the lack of grazing animals in the area. The harsh climate and arid pasture in the high mountains together with rural depopulation are the main threats that aggravate the process of agrobiodiversity conservation and allow grassland succession and loss of habitats in Serbia. With the aim to preserve the grassland on the high slopes of Stara Planina Nature Park in Serbia conservational grazing was organized on the slopes of Mučibaba, raising above 1800 m, a traditional pasture site near Senokos village. Animals: 30 Yugoslav (Serbian) ponies, 150 Busha cattle, 355 Zackel sheep (Pirotska, Karakachan and Bardoka) and 60 Balkan goats plus offspring were rotated on the natural grassland undergoing succession from 2010 to 2013 during the summer seasons. The successful reverse of ongoing succession and renewal of floristic composition and the repopulation of Mučibaba meadow with White asphodel (*Asphodelus albus*) were observed after only one season. The results obtained by swat analyses of impact of traditional grazing activity on Stara Planina on in situ preservation of Animal Genetic Resources and their habitat are presented in this paper.

Key words: *Agrobiodiversity, Grazing, Habitat, Conservation, Serbia.*

EFFECTS OF BROWSING PRESSURE ON THE TEXTURAL CHARACTERISTICS OF *JUNIPERUS COMMUNIS* L. BRANCHES

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Abstract

In the Montseny Natural Park we can find junipers scattered in the grasslands. In some of these areas of the park the breeding of small ruminants is allowed, while in others we will only find wildlife. Junipers develop differently if browsed, adopting spherical or conical morphotypes. This paper studies the mechanical characteristics of the shoots according to the sex of the bush and the branching regime to which they are subjected. 729 individual shoots were taken from male and female junipers exposed to browsing from goats and ewes and those not grazed and sampled at a different position from each bush. All the leaves were taken off the non-lignified end of the shoot to be studied by a simulated bite. The strength needed to cut the apical twigs of junipers was measured using a Volodkevich jaw, which mimics the way incisors act, using a texturometer. The diameter of the branches differs according to bushes sex being larger for females and the individuals not exposed to predation pressure. Although the differences by sex were significant, differences due to grazing pressure were larger. The annual branches were thicker and longer in non-grazed junipers. This difference was not due to the partial consumption of the studied branches, as all the samples were collected in full. The continued browsing pressure leads to a survival strategy of growing, with branches tighter packaged as was evident in the analysis of the branching structure. The longer annual branches in non-grazed bushes allow for a more open structure. The force necessary to break the branch was significantly higher on females. This could be related to the fact that the females must bear the weight of the fruits. The elasticity of the annual shoots was significantly higher on non-grazed junipers, fact that could be considered as a way to tolerate herbivorism.

Keywords: *sex dimorphism, small ruminants, juniper, grazing, morphotype.*

A NEW METHOD BASED ON INFORMATION PROVIDED BY GATHERERS AND GPS SENSORS FOR A SUSTAINABLE MANAGEMENT AND PROTECTION OF AROMATIC AND MEDICINAL PLANTS

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Abstract

The state of preservation of MAP in Albania imposes a true reflection on how their operations move towards a sustainable management. The sector was previously managed by the state and after 1991 it passed to private leadership, while resources were still publicly owned. Even there are the regulations and contracts between public administrators and private firms, the "free" access of gatherers and the pressure of the competition between economic officers led by increasing the supply create a real problem in terms of the sustainability of these resources. The objective of this study is to show that based on the information of the gatherer and the GPS traces of the activity, we can identify the habitats utilized through a cartographic image. Determining the action of gathering comes down to indirectly detecting the location of a plant species. Applying successive filters for instantaneous speed, spatial-temporal density, surface area and average of angle variations is used to model the picking area (pa) which, by aggregation on various scales, helps reconstitute the exploited habitat. This model was tested for the plant species of lime blossom. Finally, applying this approach, we can evaluate the state of plant habitats by having regular and easy-to-update automated series as well as spatiotemporal statistical analyzes. The provision of this management tool gives to professionals an objective knowledge base on aromatic and medicinal plants. They can perform extractions from the database to meet the requirements of traceability and preservation of the resource.

Keywords: *Medicinal and aromatic plants, gatherer approach, sustainable management, human sensor [GPS].*

SIMULATION OF CLIMATE CHANGE IN ALGERIA, WATER RESOURCES VULNERABILITY AND STRATEGY OF ADAPTATION

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Abstract

During the last 50 years, large parts of the Mediterranean experienced winter and summer warming. For the same period, precipitation over the Mediterranean decreased. We have used the MAGICC/SCENGEN 5.3 compound model to project future climate change in the various climate zones of Algeria, under A2 and B2 SRES scenarios, by using the selected general circulation model MIROC MED. The results of the projections show an increase in annual temperature and decrease in precipitation amount across the three horizons (2030, 2060, 2090), under the two SRES scenarios. The highest warming is observed at the Western and the Southern stations, with values lie from 1.36°C to 5.28°C. However, more drought is expected in the Eastern and southern stations, with values ranging from -3.6% to -21.5%. The Algerian water resources are mainly dependent on the precipitation which will make it highly vulnerable to these effects. The Algerian government has implemented the 2030 water sector development strategy to face the challenge of drought and water scarcity in the 21st century. It is based on four objectives: water mobilization, drinking water supply, sanitation and agricultural hydraulics. In terms of the legal framework, a new law on water was promulgated in 2005, making it possible to have, with more than thirty decrees of application, a renovated arsenal creating the conditions for integrated water resources management. A good governance, an inter-sartorial coordination, and human capacity building is necessary to achieve these aims.

Keywords: *climate change, water resources, vulnerability, adaptation.*

5. ANIMAL HUSBANDRY

SEROPREVALENCE OF BORDER DISEASE VIRUS IN ALGERIA AND ASSOCIATED RISK FACTORS

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Abstract

Border disease virus (BDV) is a pestivirus responsible for significant economic losses in sheep industry. The present study was conducted between 2015 and 2016 to determine the flock seroprevalence of the disease in Algeria and to identify associated risk factors. Total of 56 flocks from nine departments were visited and 576 blood samples were collected from adult sheep between 6 and 24 months. Serum samples from adults were tested by Ab-ELISA (Enzyme Linked Immuno-Sorbent Assay), to detect specific antibodies against pestivirus. Fifty-five flocks (98%) had at least one seropositive animal and the apparent within-flock seroprevalence was estimated to be 60.17% (95% C.I.: 52.96-66.96). Several risk factors were identified as linked to BDV such as climate, landscape, flock management and presence of other ruminant species in the farm. These high seroprevalence rates suggest that BDV is widespread and is probably endemic all over the country. Further studies are needed to detect and isolate the virus strains circulating in the country and understand the distribution and impact of pestiviruses in the Algerian livestock.

Keywords: *Border Disease Virus, pestivirus, seroprevalence, sheep, Algeria, Persistently Infected.*

OVINE SARCOSPORIDIOSIS IN SLAUGHTERHOUSES IN THE NORTH OF ALGERIA

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Abstract

Sarcocystis is one of the most common protozoan parasites in the striated muscles of cattle. In sheep, species with canids as final hosts (*S. arieticanis*, *S. tenella*) can cause clinical disease in acute sarcocystosis, such as abortion and neurological signs, while chronic infection can lead to reduced weight gain and poor production of milk and wool. Samples of the oesophagi and diaphragms of 580 sheep were collected from slaughterhouses of El Harrach to determine the prevalence of sarcosporidiosis in ovine carcasses and to identify the species involved. All samples were analyzed by the enzymatic digestion and 335 samples were examined by histological analysis. Macroscopic cysts of *Sarcocystis gigantea* were identified in six oesophagi (1.03%). Enzymatic digestion and histopathological analysis showed a very high prevalence (99.14% and 94.03%, respectively). Two *Sarcocystis* species were identified in the histological sections; *S. tenella* and *S. arieticanis*. Thin-walled cysts of *S. arieticanis* (92.54%) were more prevalent than thick-walled cysts of *S. tenella* (43.88%). The prevalence of thin-walled cysts of *S. arieticanis* was higher in the diaphragm (80.60%) than in the esophagus (62.69%). Also, the prevalence of thick-walled cysts in the diaphragm (33.73%) was higher than in the esophagus (25.67%). Indeed, the diaphragm was more infected with microscopic *Sarcocystis* cysts than the esophagus. These results indicate a heavy contamination of the environment with the dog oocysts. The role of cats seems to be minimal in the transmission of the disease. Other studies must be carried out to determine the real prevalence of sarcosporidiosis in sheep.

Keywords: *ovine carcasses, Sarcocystis, diaphragms, oesophagi.*

CLINICAL MASTITIS IN DAIRY COWS IN CERTAIN FARMS IN THE BLIDA REGION IN THE NORTH OF ALGERIA

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Abstract

The udder is often the subject of infections called mastitis, which is one of the most expensive pathologies in dairy cattle farming. For this, a survey was made in six farms located in the region of Blida in the north of Algeria to determine the prevalence of mastitis and secondary to seek the factors responsible for this disease. The detection of mastitis cases was based on the general condition of the animals, on the condition of the udders, the aspect of the retro-mammary nodes, and on the appearance and texture of the milk. The purpose of this questionnaire was to obtain general information on cows (age, number of gestations, breed, teat shape and lactation stage), on herd management (type of housing, milking parlor, number of milking by day, distribution of calving over the year, feed ration, average age at first calving and housing characteristics: type of ventilation, type of litter, condensation of animals), as well as herd hygiene (udder, milking machine and litter hygiene). The results of the survey highlighted 7 cases of clinical mastitis on a set of 41 cows, with a prevalence of 17%. These results were influenced by several factors such as the number of gestation of the female, the absence or presence of a litter and the form (shape) of teat. This makes the consumption of fresh milk at risk. For that, strict measures must be applied in our farms to control and fight against this disease that affects both our health and economy.

Keywords: *mastitis, dairy cattle, milk, farms.*

FARM SLAUGHTER BY GUN SHOT OR CAPTIVE-BOLT GUN IN SWITZERLAND

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Abstract

Farm animals for human consumption are mostly transported by the truck for 10 hours without water or feed to a big centralized slaughter house in Switzerland. That is a big stress for animals if they lose contact to the herd and experience critical situations as loading, transport, unloading, meeting unfamiliar animals, fixation for stunning. The consumer awareness in Switzerland has been growing on this issue. From a perspective of animal welfare, the transport of living animals is highly problematic. Blood samples for cortisol (stress parameter) were taken from animals after the gun shot on the farm and from animals conventionally transported to a big slaughter house. The mean cortisol concentration of the gun shot animals was $0.75\mu\text{g/dl}$, conventional transportation $4.77\mu\text{g/dl}$, factor 6.36 times more. On farm slaughtering by gun shot, captive-bolt gun or more precisely the stunning and bleeding of the farm animal on the farm and subsequently transporting the dead body to the slaughterhouse will be legal after the middle of 2020 in Switzerland. It will be a big step in animal welfare and in the relocation of animal slaughter back to small scale and regional abattoirs. Around 100 farmers and 5 butchers with farmer's groups are on the waiting list to get a permit for the on farm slaughter. They have implemented the practical work procedures (gun, caliber, ammunition, shooting distance) which will now be implemented in the law. For the whole project to be sustainable, it needs to have an economical base. The aim is to go on the market and sell the meat as "no animal transport". That is a very easy message to bring over to the consumer. Most farmers on the waiting list are direct sellers of meat. The butchers are small regional businesses that want to survive against the super markets with their big industrialized meat processing and monotonous production lines.

Key words: *cattle, on farm slaughtering, Switzerland.*

ORGANIC PASTURE BEEF WITH DAIRY BREEDS: THE USE OF MALE CALVES THAT NOBODY WANTS

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Abstract

Organic pasture beef is a program for extensive pasture based grassland beef production. It has been linked to dairy farming with fattening of crossbred offspring with beef bulls (mostly Limousine) or finishing weaners of suckler cows. This is a low input/cost production system. Its main aim is to get high productivity out of the grassland in an economical way. The big problem in Switzerland in organic milk production is what to do with the male calves of dairy breeds as nobody wants them. In Switzerland the problem is more urgent, because of the organic regulation of Bio Suisse forbids the use of semen with sperm sexing. So breeders always get 50% male calves of dairy breeds. Research Institute for Organic Agriculture (FiBL) has launched an idea of using these male calves for a new organic pasture beef program for dairy breeds for Aldi Switzerland. The main requirements are: (I) male calves from dairy breeds, (II) calves have to be castrated to be able to pasture them (III) 150 days on the dairy farm, weaned of the milk, less use of antibiotics if the calves are not transported when they are young, (IV) 800kg milk up to the 150 days, (V) 175-200kg live weight when the calf moves to the fattening farm, (VI) pasture based fattening until life weight of 600-700kg or carcass weight 300-400kg, (VII) at least 8 hours of pasture during the vegetation period and free access to outside run in winter, (VIII) summer feed is pasture grass and good grass silage and hay in winter, no corn, no concentrates, feed no food. The first results of slaughtering were very encouraging. The blind degustation of the meat showed very tasty, tender and juicy meat of the dairy animals in comparison with pure or crossed beef breeds. Of course, these results are not comparable with the crossbred animals, but at least we have a good idea of what can be done with these calves.

Keywords: *dairy male calves, meat production, Switzerland.*

EFFECT OF GRAZING LAND IMPROVEMENT PRACTICES ON HERBACEOUS PRODUCTION, GRAZING CAPACITY AND THEIR ECONOMICS IN HIGHLANDS OF BALE, SOUTHEAST ETHIOPIA

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Abstract

This study was conducted to comprehend the effects of different grazing land improvement practices on herbaceous production, grazing capacities and their economics in highlands of Bale, Southeast Ethiopia: The case of Dinsho District. Seven different treatments, i.e., application of inorganic fertilizer (Urea and Diammonium phosphate (DAP)), cattle manure, wooden ash, sodium carbonate, reseeding, weeding and a control were randomly applied to the study plots in three replications for each treatment. All experimental plots were fenced throughout the study period. The result of the study revealed that the application of inorganic fertilizer significantly increased grass (3214 kg ha^{-1}) and total biomass production ($5136.25 \text{ kg ha}^{-1}$). Regarding the grazing capacity, the study found that less land was required to maintain a tropical livestock unit (TLU) in inorganic fertilizer applied plots (0.04 ha TLU^{-1}) than in plots applied with other treatments (mean = 0.07 ha TLU^{-1}). Considering total biomass production, application of manure was advantageous to the farmers due to increased net benefits and the marginal rate of return was above the minimum acceptable rate for this sort of treatment. On the other hand, considering grass production alone, application of inorganic fertilizer was more profitable for farmers as far as they store and sell it in the dry seasons. Accordingly, for immediate soil fertility improvement of the existing grasslands, application of inorganic fertilizer is important. However, for sustainable improvement of the grasslands in the long-term, application of organic fertilizer like manure was found economical way of degraded grazing land improvement. Nevertheless, further testing is important in order to examine the effects of the different treatments on productivity of grazing lands, herbaceous species composition, vegetation nutrients, grazing capacities, the environment, and their economics to put the recommendation on strong basis.

Keywords: *Biomass production; grazing capacity; grazing land improvement; partial budget analysis.*

GROWTH RESPONSE AND FEED UTILIZATION EFFICIENCY OF COMMON CARP (*CYPRINUS CARPIO* VAR. *COMMUNIS*) FINGERLINGS TO AQUATIC WEED SUPPLEMENTED DIET

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Abstract

Three aquatic weeds namely hornwort (*Ceratophyllum demersum*), longleaf pondweed (*Potamogeton nodosus*) and fringed water lily (*Nymphoides peltata*) were analyzed for proximate composition of nutrients. It was observed that crude protein (%) in *Nymphoides peltata* was 25% which was comparatively higher than *Potamogeton nodosus* (22.57%) and *Ceratophyllum demersum* (24.15%). Similarly the percentage of dry matter content showed a high value of *Nymphoides peltata* (93.60%) as compared to *Potamogeton nodosus* (91.50%) and *Ceratophyllum demersum* (90.46%). The crude fat in *Nymphoides peltata* (5.64%) was significantly higher than *Potamogeton nodosus* (4.75%) and *Ceratophyllum demersum* (3.60%). *Nymphoides peltata* with higher % of protein was selected to be incorporated into the feed of *Common carp* to ascertain growth and feed utilization efficiency. Four isonitrogenous (CP:35%) and isocaloric (3500Kcal/kg) practical diets were formulated and *Nymphoides peltata* were added @ of 15% (T1), 30% (T2) and 45% (T3) tested diets and the control diet was formulated with 0.0% *Nymphoides peltata*. Fish with an average weight (8.95±1.1 g.) were fed on the tested diets at 5% body weight for 8 weeks. Results indicated that the fish fed with the tested diet (T3) had a significantly higher weight gain (17.09±0.55) and specific growth rate (1.106 ± 0.01) as compared to the control group ($P < 0.05$). FCR decreased significantly in fish fed diets containing *Nymphoids peltata* @ 45%. The FCR and PER was significantly ($P < 0.05$) different from the control group. FCR (2.81±0.19) was lowest in the T3 group and highest PER (1.78±0.07) was observed in the T3 group as compared to control group. Mortality was recorded during the feeding trial and lowest mortality was observed in control group followed by T3 group. The results indicated that *Nymphoids peltata* improved growth performance of *Common carp* as compared to control group. The selected weed also replaced fishmeal up to 45% without having any adverse effects on growth and survival.

Key words: *Common carp*, *aquatic weed*, *Nymphoids peltata*, *fishmeal*, *survival*.

FEATURES OF MORPHOLOGY OF THE HEART IN THE MILK PERIODS LAMBS

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Abstract

The heart of lambs in 1 and 3 months of age was examined with a complex of morphological methods used. It was established that in lambs in the milky period, the anterior contour of the heart reaches the 3rd rib, and the posterior to the 6th. The apex of the heart is located at or behind the costal cartilage 5, not reaching the chest cavity by 2 cm, and in front of the diaphragm by 2-5 cm, this indicator depends on the phase of respiration. Insertion discs between cardiomyocytes are poorly differentiated, as is transverse striation. In animals of one month of age, a weak transverse striation of cardiomyocytes is manifested, however, in the interventricular septum it is more pronounced than in the atria and ventricles. The largest relative area of cardiomyocytes is concentrated in the left ventricle, however, working cardiomyocytes are larger in the interventricular septum, and conductive ones in the left ventricle. The index of elongation of the nucleus increases to a greater extent in the right atrium. The relative area of loose fibrous connective tissue increases asynchronously. In 3-month-old lambs, transverse striation is most pronounced. In the right and left atria, the relative area of loose fibrous connective tissue decreases, while in the ventricles, on the contrary, it increases. An increase in the coefficient of elongation of the nucleus occurs with the age of the animals. The revealed dynamics of the structure of tissue components of the myocardium of lambs must be taken into account when detailing the pathogenesis of diseases of sheep occurring with impaired cardiac activity.

Keywords: *morphology, heart, myocardium, lambs, milky period.*

SUSTAINABLE CONTROL OF GASTROINTESTINAL PARASITES IN GOATS OF HILLY AREAS OF JAMMU AND KASHMIR (INDIA)

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Abstract

Haemonchus Contortus is a major parasitic problem in goats causing diarrhoea, anaemia, reduced weight gain and increased production costs. A total of 60 goats 1-3 years of age naturally suffering from gastrointestinal parasitic infection were selected and divided into 3 groups. Group A and Group B with 25 goats each and Group C with 10 goats as control group. Goats in group A were given 3% Morantel citrate oral solution (Banminth), goats in group B were given Closantel bolus (Zyclose) and Group C goats were not given any treatment. Present study was conducted with following objectives in mind a) To control the parasitic infection in goats and to find the kind of parasitic infection i.e single or mixed, b) To check the efficacy of drugs used and c) To find out the most effective drug. Drug efficacy was evaluated on the basis of reduction and absence of eggs as well as clinical improvement. The EPG(eggs per gram) count and clinical examination was made on 0, 7th, 14th and 21st day of post treatment. General condition like anaemia, diarrhoea, loss of weight, alertness, appetite, feed consumption physical appearance etc were also observed. The observation revealed that EPG of group A and B goats was 380 ± 30 earlier which came down to almost 0 ± 2 on day 21st post treatment and goats in group C still had high EPG till 14th and 21st day. It was also seen that some goats in group B showing symptoms of liver fluke infection also responded to the treatment of Closantel. This indicated that there was mixed parasitic infection in these goats. Thus Group A and Group B drugs showed positive results for controlling parasitic infections but being a mixed infection it was suggested to go for a holistic approach for sustainable control of these parasites.

Keywords: *Morantel citrate, Haemonchus Contortus, Closantel, EPG, Liver fluke.*

BIOACTIVE FORM OF VITAMIN D IN THE DIET AFFECTS SOME EGG QUALITY CHARACTERISTICS AND SERUM CALCIUM AND PHOSPHORUS LEVELS IN LAYING HENS

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Abstract

Vitamin D may be supplied to poultry either through the diet or by exposing the skin to ultraviolet radiation from the sunlight. In this study we aimed to determine if providing a feed mixture of vitamin D₃ and 1,25(OH)₂D₃ or exposing hens to sunlight could influence egg production, egg quality, feed consumption and serum calcium and phosphorus levels in commercial laying hens housed on the floor litter. A total of 240 16-week-old Lohmann brown layers were randomly assigned into four groups with three replicates per group and 20 hens per replicate. Groups were formed so that hens were fed with: (1) B, a basal diet fortified with 3,000 IU/kg vitamin D₃; (2) BP, a basal diet (3,000 IU/kg vitamin D₃) supplemented with 1 µg/kg 1,25(OH)₂D₃; (3) BS, basal diet and hens exposed to sunlight (3,000 IU/kg vitamin D₃ + sunlight) and (4) BPS, basal diet (3,000 IU/kg vitamin D₃) supplemented with 1 µg/kg 1,25(OH)₂D₃ and hens exposed to sunlight. Layers were exposed to sunlight once a week for 3 h over a period of 36 weeks. Eggs were collected at 24, 30, 45 and 52 weeks of age. A total of 697 eggs was used. The different forms and sources of vitamin D influenced ($p < 0.05$) yolk color and diameter, shell color and strength, albumen height, Haugh units and pH of albumen. Hens from BP group had a significant ($p < 0.05$) lower values for albumen height, Haugh units, shell and yolk color in comparison with hens from B group, but higher albumen pH ($p < 0.05$). Egg shell strength was higher ($p < 0.05$) in BP group compared to BPS group. Hens from groups with 1,25(OH)₂D₃ in the diet had higher serum phosphorus and calcium concentrations. Egg production and feed intake were indifferent between groups. Although results from egg characteristics may be difficult to interpret in favour of a particular form of vitamin D, serum results show a clear positive affect of bioactive form of vitamin D supplementation in the diet in laying hens.

Key words: *chicken, vitamin D, performance, egg quality, serum calcium, serum phosphorus.*

CATIMING AND 25-HYD AS A FACTORS TO IMPROVE EGG QUALITY IN LAYING HENS HOUSED IN A COMMERCIAL AVIARY SYSTEM

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Abstract

In addition to the quantity of eggs produced, their quality is also extremely important for the modern industry. Part of the main parameters for determining the quality of eggs are the strength and thickness of the eggshell. Studies have shown that the laying of eggs with low shell strength leads to large economic losses due to contamination of the eggs and creation of preconditions for bad habits in the laying hens. The aim of our study is to apply an established technique CaT (Thiele, 2016) along with a second factor (25-hydroxycholecalciferol, HyD) known to increase calcium absorption (Soares et al 1995). For the experiment, a total of 240 birds were used that were exposed to one of four treatment combinations in a 2X2 factorial design (Factor 1: CaT-CON / Treated; Factor 2: HYD-CON / HYD). As a result of our research, we found that the strength of the eggs was highest in the CaT⁺ /HYD⁻ group, followed by CaT⁺ /HYD⁺ and CaT⁻ /HYD⁺. The egg shell thickness was again greatest at CaT⁺ /HYD⁻, followed by CaT⁺ /HYD⁺ and CaT⁻ /HYD⁻.

Key words: *laying hens, egg parameter, CaT, HyD.*

IMPACT TESTING AND PROPENSITY SCORE FOR SPONTANEOUS KEEL BONE FRACTURES IN LAYING HENS RECEIVING DIFFERENT DIETS

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Abstract

Keel bone damage (KBD) in laying hens is a serious problem faced by modern industry. Studies have shown that KBD, albeit very diverse, occurs in all genetic lines and housing systems (including traditional battery cages, furnished cages and non-cage systems). The aim of our study is to apply an established technique (CaTiming; CaT), which is often used in the end of the laying period to improve the quality of the shell in a new way - to reduce the KBF in the early stages of laying, along with a second factor (25-hydroxycholecalciferol, HyD) known to increase calcium absorption. The ability of CaT and HYD to reduce fracture susceptibility was tested using an ex vivo protocol. For the experiment, a total of 240 birds were used that were exposed to one of four treatment combinations in a 2X2 factorial design (Factor 1: CaT-CON / Treated; Factor 2: HYD-CON / HYD). After one week of habituation (34 weeks), all birds began to receive one of four combinations (n = 2 replicates/treatment combination). As a result of our research, we found that the likelihood of fractures in birds in the CaT⁺ / HYD⁺ group was at times lower than that in the control groups, followed by CaT⁺ / HYD⁻ - 1.57, while in CaT⁻ / HYD⁺ the probability of fractures was 1.45 times higher.

Key words: *laying hens, keel bone fractures, CaT, Impact Testing.*

STUDY OF A TRADITIONAL SHEEP FARMING IN THE WILAYA OF BISKRA IN ALGERIA

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Abstract

Sheep farming is an important source of meat in Algeria, despite its refolement to unfavorable areas. The sheep population is estimated at 26 million heads with 325,000 tons of sheep meat. It provides a living for a third of the population and makes it possible to exploit 12 million hectares of arid zones. The objective of the study was to follow a traditional breeding. The study was carried out in 2018 in the municipality of Sidi Okbawilaya of Biskra. The herd consisted of 333 Ouled Djellal sheep. The farm had 3 sheepfolds and a shed. Habitat, reproduction and food were studied. The flushing method was applied to 257 ewes to which we placed vaginal sponges impregnated with a synthetic progestagen, flugestone acetate. After removing the sponges, the female sheep were put to the fight. The sheepfolds of 150 m² were built using trunks and palm leaves (Djeride). The flock was made up of sheep (81.68%). The ewe reform rate was 5.51%. The average age of sheep was 3.58 ± 1.74 years. The synchronization of heat affected 94.49% of the female sheep. Lambing affected 77.43% of the sheep put in the fight. The number of lambs born was 368, of which 15.08% were twin births. Mortality concerned 7.88% of births. The mastery of livestock management is a key factor for its success.

Keywords: *traditional breeding, sheep, feeding, reproduction.*

INCIDENCE OF SUBCLINICAL CAPRINE MASTITIS

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Abstract

Goat industry is progressively emerging as a major player in the field of agricultural economy. Consequently the disease management has become more important for production and economic reasons. Despite advancement in various therapeutic regimens and improved management practices, mastitis continues to be a major concern. Subclinical mastitis is a multi-etiological complex disease, and is characterized by physical, chemical and usually bacteriological changes in milk and pathological changes in glandular tissues. Three hundred thirteen milk samples from apparently healthy lactating goats from the ICAR-CIRG sheds (Jamunapari-162, Jakhrana-40 and Barbari-111) were screened for subclinical mastitis on the basis of California mastitis Test (CMT test), Somatic Cell Count (SCC) and Bacterial isolation from milk. The CMT positive milk samples were collected for Somatic cell count (using Newmanns stain) and bacterial isolation. The CMT positive animals which sample showed a SCC count of more than 150,000 cells per ml milk were subjected to bacteriological isolation. Twenty three Jamunapari goat samples were found positive for subclinical mastitis suggesting 14.2% prevalence rate followed by a prevalence rate of 8.1% in barbari. Out of 40 Jakhrana samples, only 10 were found positive for subclinical mastitis suggesting 25% prevalence rate of subclinical mastitis among Jamunapari goats. Concurrent multiple infections in the milk sample were a common observation and the infections differed among the samples from two teats of same animal in case of Jamunapari and Barbari. In case of Jakhrana goats, the subclinical mastitis samples did not reveal any bacteriological culture.

Key words: *Mastitis, Goat, Incidence, CMT, SCC.*

EFFECT OF METHANOLIC POLYHERBAL EXTRACTS ON COCCIDIOSIS IN GOATS

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Abstract

Coccidiosis is one of the most important parasitic diseases of goats, caused by intestinal protozoan *Eimeria*, leading to huge economic losses owing to high mortality and morbidity, poor growth along with an extra treatment cost worldwide. Organic management of food animal disease is an important concern for reducing tissue residues of drugs used as feed additives to control coccidiosis. Three plants were selected and their components were extracted in methanol. Two polyherbal prototypes were prepared and the study was conducted to assess their efficacy to reduce the incidence of coccidiosis by experimental oral feeding (with two doses of 5 ml of each prototype as 1% solution w/v) of *Coccidia* infected goats (n=6) on two consecutive days and the faecal egg count was monitored on regular basis up to 5 months. Albendazole and potassium permanganate were given as positive and negative control, respectively. Both the prototypes were quite effective in partially controlling the coccidial load. Albendazole showed excellent anticoccidial effect but there was a marked reoccurrence of fecal load within 60 days while both the prototypes gave a slow but gradual rise in the reduction of the parasitic load. The prototype A reduced the coccidial load by 82% on 60th day while prototype B showed a maximum reduction of 55% on 30th day of first treatment as compared to control. The effect of prototype A was more persistent compared to prototype B. This result gives more impetus to analyze the anti-coccidial properties of plant herbs and their scope in controlling the economic losses to farmers.

Key words: *Herb, Coccidia, Goat, Methanolic Extract.*

A META-ANALYSIS AND META-REGRESSION OF THE PREVALENCE OF SUBCLINICAL MASTITIS IN DAIRY CATTLE IN TURKEY

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Abstract

Meta-analysis is a statistical method used to combine, synthesize the results obtained from individual studies conducted on a specific subject, and to interpret the result by converting it into a common unit of measurement. It is aimed to increase the accuracy of parameter estimates by combining the results of the studies carried out with small samples with a meta-analysis in a consistent and harmonious way and increasing the sample width. In this study it is aimed to carry out a meta analysis of prevalence of subclinical mastitis detected in 41 studies conducted in Turkey between the years 1988-2019. The prevalence of mastitis (out of 41 studies that make up the study material) was determined by 37 cow-based (n=11,182 heads) and 33 quarter-based (n=48,990 quarters) studies. The random effect model assumes that there are differences in effect size across all studies. In the meta analysis applied in the study, random effect model was used. Egger's linear regression test and funnel plot were used to determine whether there was bias in the study sample. As a result of meta analysis, it was observed that there was a high heterogeneity between both cow-based and quarter-based studies ($I^2=98.5$ and $I^2=99.3$, respectively). According to the random effect model, the pooled prevalence of subclinical mastitis was 0.46 (95% CI: 0.37; 0.56) in cow-based studies, and as 0.29 (95% CI: 0.23; 0.35) in quarter-based studies. With the meta-analysis performed in this study, more precise estimation opportunity was provided by eliminating the inconsistencies related to the effect size in the population of subclinical mastitis prevalence of individual studies conducted in Turkey. However, in order to obtain correct results it is necessary to select and analyze the studies included in the analysis systematically and carefully, use the appropriate statistical model and interpret the obtained analysis results correctly.

Keywords: *Meta-analysis, subclinical mastitis, dairy cattle, Turkey.*

**PRELIMINARY RESULTS ON THE ARTIFICIAL REPRODUCTION OF
HYPOPHthalmichthys molitrix AND *ARISTICTHYS NOBILIS*
(CYPRINIDAE)**

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Abstract

Experiments were carried out in a mobile hatchery in order to master different techniques of artificial reproductions of the big head carp *Aristichthys nobilis* (Richardson, 1845) and the silver carp *Hypophthalmichthys molitrix* (Valenciennes, 1844) through the various following steps: fishing of wild carps, selection and sexing of the broodstocks, adaptation and conditioning of the spawners for hormonal treatment, hypophysation of the spawning fishes, gametes harvesting, fertilization of eggs, incubation and finally transport and release of the fingerlings into wild water bodies. The successful results are presented considering that these experiments have been intended to serve as a tool for greater production fingerlings of these Chinese carps for the seeding of numbers of water bodies as well as to serve as a source of supply for fish farmers. This will reduce the costs of imports of live fishes and avoid the risks of the transfers of pathogenic entities.

Keywords: *Artificial reproduction, Hypophysation, Aristichthys nobilis, Hypophthalmichthys molitrix, Cyprinidae, Algeria.*

THE INFLUENCE OF MEDIUM OF RIPENING ON ANTIOXIDANT POTENTIAL OF REDUCED-FAT WHITE CHEESES

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Abstract

The influence of medium ripening (brine or vacuum) on antioxidant potential of reduced-fat cheeses prepared from milk that remained after Kajmak production has been analysed. Cheeses were ripened for 60 days in brine (6%) or in polyethylene bags under vacuum. The change of antioxidant potential of investigated cheeses during 60 days of ripening was followed by three different methods: ABTS radical scavenging activity, iron (II) chelating activity (ICA) and reducing power (RP). According to the obtained results medium of ripening in general significantly affected antioxidant potential of reduced-fat white cheeses. Fresh cheeses (3-day-old cheeses) had similar ABTS radical scavenging activity, but significantly different ICA and RP values. The ripening in brine and in vacuum differently affected the trend of ICA and RP values. The iron (II) chelating activity of VC cheeses increased during 40 days. During the same period ICA values of BC cheeses slightly, but significantly, decreased. After that period, the ability of iron (II) chelating dropped sharply in both types of cheeses. The ripening in brine and in vacuum had almost similar trend of ABTS radical scavenging activity. The radical scavenging activity of both cheeses slowly increased and reached maximum at 40th day of ripening. After that period, the radical scavenging activity of cheeses ripened in brine was unchanged, whereas in vacuum-ripened cheeses it decreased. Contrary to our predictions, due to more intensive proteolysis, 60-days old cheese ripened in brine had more favorable ABTS radical scavenging activity and iron (II) chelating activity, but slightly lower reducing power comparing to vacuum ripened cheese.

Key words: *Reduced-fat cheeses, antioxidant potential, medium of ripening, proteolysis.*

INFLUENCE OF THE TEMPERATURE-HUMIDITY REGIME IN DAIRY CATTLE BUILDINGS ON SOME BLOOD CELL PARAMETERS

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Abstract

The present study examines the influence of the temperature-humidity index (THI) on some haematological parameters and leukocyte indexes in dairy cows during transitional (spring and autumn), summer and winter periods. It was ascertained that in the summer the hematopoiesis increased and as a result, the number of the erythrocytes of the animals from all three farms built up by 7-8 %, while during the transitional and winter periods their number remained unchanged. Similar increase was also observed with reference to the haemoglobin (10- 15%) and the number of leukocytes (more than 6%). Furthermore, they were also in positive and high correlative dependency on THI: ($r=0,545$; $r= 0,480$ and $r= 0,695$ respectively). The leukocyte increase during the summer was not linked to any change in their groups. In most of the leukocyte groups, the fluctuations were within the physiological norms. Therefore, it may be assumed that despite the high THI during the summer, the immunological reactivity of the animals remained stable. Monocytes increase (6,5- 10) was observed during the transitional period in the animals which were bred in open houses. The blood cell coefficient (BCC) also marked its highest values during the summer (from 0,98 to 1,08), followed by the winter (0, 83-0,93) and the transitional period (0,68-0,84). The lymphocyte- granulocyte index (LGI) as well as the neutrophils and lymphocytes ratio were to a large extent dependent on the season and the type of farm- $P<0,001$. What is more, they also displayed high, but mutually inverse correlation with THI ($r=0,939$ and $r= 0,940$ respectively). The lymphocyte/eosinophils and neutrophils/eosinophils indexes were almost equal during both the hot summer and cold winter periods.

Keywords: *dairy cows, heat stress, blood cell parameters and indexes.*

IMPLICATIONS OF PESTICIDE USE FOR BALKAN BEEKEEPING WITH COMPARATIVE ANALYSES FOR IMPLEMENTING BEST PRACTICES IN BOSNIA AND HERZEGOVINA

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Abstract

This study represents a comparative analyses of the impact of agricultural pesticide use on apiary operations in the region of Southeastern Europe which, for the purposes of this report, will be comprised of Serbia, Croatia, Slovenia, and include a special focus on Bosnia and Herzegovina. We are interested in recent data that can be presented for a technical academic audience coming to beekeeping events in the Balkans. Specifically, based on current research on bee mortality and pesticide use, we would like to present the implications for apiary science and best practices for beekeepers in the Balkans, and the area surrounding Bosnia and Herzegovina, in particular. Pesticides are used to protect agricultural field crops and flowering plants. Honeybees (*Apis mellifera*) near these agricultural operations will pollinate these plants, ingesting and carrying the pesticides. Large-scale studies have shown that some of these pesticides, particularly the neonicotinoid class, can negatively impact bee health, which prompted the European Union in 2013 to ban the use of three neonicotinoids on flowering plants. Additional stressors like the need to overwinter can lead to additional bee deaths. In this paper, we will first describe some of the background information relating to the beekeepers of the Balkans. We will then examine the most recent data from 2015 to 2019 on honeybee mortality in the Balkan countries. Next, we will examine the findings of three studies on bee mortality done in regions of similar climate to the Balkans. And last, we will gather government and industry recommendations for beekeepers on limiting exposure of their bees to pesticides. Data from neighbouring countries such as Macedonia, Albania, Greece, Montenegro, etc., and non-European countries, will also be used when appropriate.

Keywords: *Bee mortality and pesticide use, Colony loss, Apiary science, Bosnia and Herzegovina, Balkan Beekeeping.*

ON FARM TEMPERAMENT TESTING IN DAIRY CATTLE BY THE NOVEL OBJECT TEST

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Abstract

Presented study aims to design on farm test temperament in dairy cattle due the individual differences in behavior during novel object test. Fifty-three dairy cows were tested on commercial farm by the novel object test (red cycling light in flashing mode) placed at the end of 11 m long corridor leading from milking parlour to the stall. Behavior was recorded by two video cameras and analyzed from the records. Individual differences in the behavior were evaluated by differences in speed of approaching the novel object. Because of differences in walking speed in the cows the corrected time of approaching (CTA) was calculated from real time of approaching the novel object, number of stops and 1st stop distance. Dividing to groups with similar behavior was performed by k-means cluster analysis by CTA. Results indicated apparent differences among individual cows. CTA ranged from 11 s. to 482 s. K-means clustering divided group of tested cows to 4 distinctive clusters. Cluster 1 was named calm, consisting of 28 members, mean CTA was $23 \text{ s} \pm 41$. Cluster 2 was named curious, consisting of 14 members, in 8 of them the voluntary approaching was recorded, mean CTA was $52 \text{ s} \pm 71$. Cluster 3 was named vigilant, consisting of 9 members, mean CTA was $98 \text{ s} \pm 128$. Cluster 4 was named fearful, and it had 2 members, mean CTA was $250 \text{ s} \pm 312$. Results showed possibility to accurate assessment of temperament type by simple on farm test. Only 2 of tested dairy cows had inappropriate type of temperament, with higher risk of problems with habituation to novel object or during manipulation. The research was supported by KEGA 015SPU-4/2019

Keywords: *dairy cattle, novel object, on farm, temperament, test.*

INTERPLAY OF OXIDATIVE STRESS AND ANTIOXIDANTS DURING VACCINATION AND CHALLENGE IN MICE MASTITIS MODEL

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Abstract

Vaccination always imposes oxidative stress in animal immune system and may adversely affect the production. In contrast, development of oxidative stress is also required for successful vaccination. Thus in present study, an indigenous combined nanoparticle based polymer gel adjuvant vaccine (PGV) was studied for the interaction of oxidant and antioxidant system in mice mastitis model. Seventy two adult albino female mice, divided in three groups (n=24), were inoculated 100 µl of vaccine, polymer gel and PBS through subcutaneous route in Group I, II and III, respectively. All mice were challenged by intra mammary inoculation of 100 live virulent *S. aureus* (Accession no.MH092071) and *E. coli* (Accession no. KY914488) on 28th day post. Group I revealed highest level of CAT activity with significant (p<0.05) difference from control mice group on 14th day post vaccination and post challenge significantly (p<0.05) higher level than control mice group. The GST levels were significantly (p<0.05) lower in Group I on 14th day onward after vaccination and challenge but recovered to be higher than adjuvant group on challenge. The LPO levels showed significant (p<0.05) increase in Group I in comparison to control mice group on 14th day to 28th day post vaccination. The post challenge level of LPO was significantly (p<0.05) lower in comparison to adjuvant-inoculated and control mice group. The superoxide dismutase activity (SOD) level in vaccinated mice erythrocytes reduced significantly (p<0.05) initially on 7th day post vaccination and then recovered to normal values on 14th day onwards. The erythrocyte GSH levels reduced significantly (p<0.05) from control and adjuvant-inoculated mice groups to recover on 14th day and then maintained up to 28th day with final significant value (p<0.05) in surge on 7th day post challenge. The mice erythrocyte total protein was increased in PGV vaccinated mice with significant rise (p<0.05) from control mice group on 28th day post vaccination. To conclude, Catalase, SOD, reduced GSH, GST and LPO in vaccinated mice group revealed positive production of reactive oxygen species and free radicals as required for effective immune response.

Key words: Mastitis, Oxidative stress, Antioxidant, Reactive oxygen species, Mice model.

WHOLE GENOME DRAFT AND FIRST REPORT OF *BRUCELLA ABORTUS* 2308 FROM INDIA

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Abstract

Brucellosis, a neglected bacterial zoonosis affecting both human and animals, is mainly caused by *Brucella melitensis* and *Brucella abortus*. For the control of human brucellosis, it is imperative to control it in animals. Brucellosis is endemic disease in India with 4.5 to 12.00 % seropositivity. In India, culling of cattle is not acceptable due to mythology so vaccination is the only method to reduce Brucella incidences. The status of filed strain was not clear so we performed the isolation and whole genome sequencing analysis of the isolate obtained from the placenta of aborted cattle during abortion storm in a dairy farm of cross-bred cattle. The blast with publically available Brucella genomes confirmed it as *Brucella abortus* 2308. It is the first report of isolation and whole genome sequence of *Brucella abortus* 2308 from India and has been submitted in NCBI data base. Strain 2308 is the most virulent strain of *Brucella abortus* and is highly pathogenic to human. The *Brucella abortus* strain -19 vaccine, only vaccine recommended for vaccination in India, is also reported to provide less effective protection at parturition after *Brucella abortus* 2308 infection during mid to late gestation. Moreover, lack of DIVA strategy for Strain-19 vaccination is going to create hindrance in future sero-diagnosis of brucellosis. Thus, WGS of filed isolate of *Brucella abortus* 2308 and its comparison with Strain-19 WGS may lead to development of DIVA for future epidemiological and serodiagnosis and can lead to better and effective control of Brucella in India.

Key words: Whole genome sequence, *Brucella abortus* 2308, Strain-19 vaccine.

GENETIC CORRELATIONS FOR REPRODUCTIVE AND GROWTH TRAITS IN RABBITS

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Abstract

Genetic parameters for reproductive (litter size at birth, number of born alive and litter size at weaning), growth traits (individual weaning weight and individual weight at the end of the fattening period) and the genetic correlations were estimated. A total of 805 females, 3,242 parities and 18,472 growth records were measured from 2006 to 2017. A penta-variate animal model was used with reproductive and growth traits. Heritability ranged from 0.025 to 0.126 for reproductive traits and from 0.033 to 0.059 for growth traits. The repeatability of reproductive traits was low and the common litter effect for growth traits was the most important component of total variance. The genetic and phenotypic correlations between reproductive and growth parameters were high and negative, especially with weight at weaning (-0.848, -0.922 and -0.854 for litter size at birth, number of born alive and litter size at weaning, respectively). In conclusion, both reproductive and growth traits should be selected in independent lines and the response to selection should be mainly due to the high coefficient of variation of the traits.

Key words: *genetic correlation, heritability, litter size, weaning weight, rabbits.*

CHARACTERIZATION OF SEMEN OF THREE RABBIT BREEDS AND ARTIFICIAL INSEMINATION

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Abstract

This work aims to study the quantitative and qualitative characteristics of the semen of 3 rabbit breeds, and to compare zootechnical growth performances related to reproduction in females conducted by natural mating (NM) or artificial insemination (AI). Thirty males aged of 5-6 months were divided into 3 groups of 10 each (local population, Californian, hybrid). Throughout the experiment, two successive ejaculates were collected twice a week during 6 weeks. Furthermore, 20 nulliparous rabbits were divided into two groups of 10 each (group of females were artificially inseminated (AI) and group of females conducted in natural mating (NM)). No significant differences were noted between 3 male groups for the average ejaculate volume (1.11 ± 0.43 ; $p > 0.05$), pH (7.16 ± 0.18) and individual motility (2.36 ± 0.4 ; $p > 0.05$). However, bucks of the local population showed significantly higher massale motility compared to that recorded in hybrid rabbits (+ 30%; $p < 0.05$) on one hand, and Californian rabbits on the other hand (+ 27%, $p < 0.05$). The average concentration of semen on spermatozooids per ejaculate was comparable between hybrids and Californian rabbits, but significantly lower in local rabbits (-30%, $p < 0.05$). The fertility rate was 76.92% against 53.84% in NM and AI, respectively. The total number of kits newborn was higher in NM compared to AI (6.5 ± 1.25 vs. 5.42 ± 1.90 , a difference of 16%). However, the difference recorded was not significant ($p > 0.05$). It should be noted that the stillbirth rate was equal in both groups of females. The number of weaned rabbits by weaning and mortality between birth and weaning were 4.6 ± 1.50 and 38.80% and 4 ± 1.2 and 35.71% in NM and IA, respectively. The use of artificial insemination in Algeria for the first time has given very encouraging results. However, further works on more effective and more advanced parities seem necessary.

Keywords: *rabbit, semen, fertility, biotechnology.*

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

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.*

EVALUATION OF EXISTING SHEEP INTAKE MODELS UNDER BRAZIL PRODUCTION SYSTEMS

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Abstract

Modelling and simulation are technics used to study a real agricultural production system and their results can help the farmers make decisions in order to plan and monitor their system. The goals for this work were to search the existing literature for developed models to estimate the voluntary intake (VI) by lamb finishing on pasture-based system and to validate the equations for use in Brazilian production systems. Results from literature review on sheep production systems were registered and stored in a data basis (DB) and used to calculate pasture in offer, carrying capacity, adult animal weight, average daily gain for animal and land. Three models were selected as Cabral2008, Freer2010 and McCall1984 and results were compared to existing DB. Cabral2008 and Freer2010 developed the equations to estimate the VI on animal data only without considering information on pasture and ambient, difference was that Freer2010 had ambient temperature and animal physiological state. McCall1984 estimated VI by a grazing animal including forage on, forage quality and ambient temperature and that generated a correction factor (CF – relative intake) with a 0 to 1 scale, indicating the time when VI would be depressed. By introd from DB was used in the equations of each model with estimated results compared to those from original experiments. Another estimation obtained for VI was by introducing the correction factor from McCall1984 into equation of Cabral2008 generating another result (Cabral + McCall). Comparisons were by Dunnet test. Estimated average VI in kg.DM.day⁻¹ was 0,854 (DB), 898 (Cabral2008), 1,357 (Freer2010), 1,247 (McCall1984) and 0,800 (Cabral+McCall), respectively. VI from DB, Cabral2008 and Cabral+McCall did not differ. Results from Freer2010 and McCall1984 overestimated VI by finishing lambs and were different from DB.

Keywords: *farm plan, performance, grazing, simulation, predicted equations.*

SIMULATION OF A SHEEP PRODUCTION SYSTEM WITH DIFFERENT FORAGE ALLOWANCE

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Abstract

This research had the objective to evaluate the use of mathematical models to estimate the voluntary intake by grazing sheep. The estimated consumption was used to plan a sheep production system on a Buffel grass (*Cenchrus ciliaris L.*) pasture and concentrate supplement to finish lambs. From a data base stored information was obtained through an experiment where voluntary intake and lamb performance grazing on two Buffel grass cultivars Biloela and Cpatas 7754 under three forage allowances (FA) of 4%, 8% and 12% of live weight. The simulated system used a pasture area of 10 hectares (ha), 11 heads per ha and equations added by a correction factor proposed in the literature. Results show that the model permitted to identify that the voluntary intake decrease due to the less forage on offer. As consequence, estimated time in days for, lambs to achieve the final live weight of 30 kg were 208, 204 and 157 days, respectively for 4%, 8% and 12% body weight. As expected, when the forage on offer was higher with 12% of Buffel grass availability, it resulted in higher intake and less concentrate feed supplementation with a larger gross margin as compared to scenario with 4% and 8% of forage allowance to finish lambs on pasture.

Keywords: *prediction equations, lamb finishing, voluntary intake, forage offer, gross margin.*

EMERGENCE OF BOVINE CARRIERS OF ANAPLASMOSIS IN MEERUT AND ADJOINING AREAS, INDIA

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Abstract

Bovine anaplasmosis is among one of the economically important tick borne diseases of dairy animals in the world. The disease is caused by *Anaplasma marginale*, a rickettsial pathogen and clinically characterized by anemia in ruminants leading to significant economic losses. The present cross-sectional study was conducted to determine the prevalence of anaplasmosis and evaluation of traditional therapeutic line of treatment. A total of 58 cattle (Indigenous and crossbred cows) presented to Veterinary Clinical Complex, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut and inspected during the visit of dairy farms located in the area were examined clinically and blood samples were collected for laboratory analysis. The animals had the history of fever, anorexia, reduction in milk yield and tick infestation. The blood samples were analyzed for prevalence of bovine anaplasmosis using classical giemsa stained thin blood smear parasitological method and complete blood count. On blood smear examination of a total of 32.75% (19/58) dairy animals, the presence of dense, rounded, intra-erythrocytic bodies on the erythrocytes was showed. Complete blood count analysis of animals revealed that the animals were anaemic (hemoglobin= 4-7 g/dl). Another clinical finding in case of animals was that the majority of animals were having history of fever, followed by normal body temperature. Following treatment with oxytetracycline parenterally @ 20 mg/kg body weight intravenously along with supportive therapy 85 % (50/58) was applied and animals recovered without any side-effects. The present study concluded that there was emergence of bovine anaplasmosis in this part of the country showing the high prevalence of clinical cases. The traditional treatment with oxytetracycline yielded excellent result showing recovery in majority of the clinical cases.

Keywords: *anaplasmosis, cattle, dairy animals, giemsa staining, oxytetracycline.*

STUDY OF HISTOFUNCTIONAL CHANGES IN UTERINE AND MAMMARY STRUCTURES IN LATE PREGNANCY OF DOE RABBIT

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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 treated 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.*

DETERMINATION OF FIRE DEPARTMENT SEARCH AND RESCUE DOG TEAMS CAPACITY

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Abstract

Well-trained search and rescue dogs are used to locate and alert trapped or missing persons in disasters situations resulting from explosions or natural disasters; earthquakes, floods, landslides, fires, or other activities. These highly skilled dogs use their noses to find living victims under emergencies. In this study, the capacity of the fire department search and rescue dog teams in Turkey was examined. The data were collected as a result of the survey conducted with 9 employees, aged between 18 and 49 years old, from different provinces of Turkey. The professional experiences of the firefighters reach twenty years and they have 37 search and rescue dogs, totally. Firefighters often encounter cases of land loss and debris-dent. The majority of workers have canine search and rescue equipment. It is seen that the participants work in cooperation with Turkish Disaster and Emergency Management Presidency (AFAD) units, volunteer organizations, relatives of the missing people, military search and rescue teams and eyewitnesses.

Keywords: *Fire department, Search and Rescue Dog.*

CONSIDERATIONS REGARDING THE MOUNTAIN PRODUCT IN ROMANIA: PRESENT STATE AND PERSPECTIVES IN RELATION TO THE CATTLE BREEDING ACTIVITY

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Abstract

The paper aims to present the situation of the mountain product in Romania, between June 2017 and March 2020. This work is based on statistical data provided by the National Sanitary-Veterinary and Food Safety Authority, the National Institute of Statistics and the National Agency of Mountain Area (ANZM). These data were processed within the National Agency of the Mountain Area (ANZM), in the following indicators: number of counties with mountain area, number of administrative-territorial units, total area of the mountain area (km²), number of animals in the mountain area (cattle, sheep, goats, pigs), number of mountain products and categories of mountain products certified in Romania. Compared to the year 2017, the number of mountain products that benefited from the qualitative mention of mountain product increased, reaching 2020, to 491, according to the National Register of Mountain Products. This shows the recognition of the quality of the products obtained in the mountain area of Romania. The bovine species, with the two main productions, milk and meat has a significant influence on the mountain product at national level, but also in the Dornelor Basin. Analyzing the graphical representation of the mountain product we find that dairy products are the most widespread (50%), followed by vegetable products by 30%, and followed by bee products by 17%.

Keywords: *mountain product, Romania, livestock, bovine.*

EFFECT OF *BACILLUS* SPP. FOOD ADDITIVES ON WEIGHT IN WEANED PIGLETS

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Abstract

To improve pig farming and reduce losses in the most vulnerable categories of pigs, either in suckling piglets or weaned piglets, in addition to basic nutrients in complete mixtures, piglets are given a large number of feed additives for different purposes. Feed additives are substances that are added in very small quantities in order to improve the health of animals. In recent decades, scientists and experts have been paying more and more attention to the so-called “alternative” additives, of which enzymes, organic acids, probiotics and prebiotics are the most frequently mentioned. Due to many unknowns that accompany these products in their use, especially in our country, we have selected the probiotic based on bacteria *Bacillus* spp. to test it and its effect on the weight of piglets. The research included piglets of the Swedish Landrace breed, and was conducted in three separate experiments (I, II and III) in the same facility on a mini-farm. In the first and second experiment, 56 piglets were used (28x2), in the third there were 88 piglets (44x2). In each of the three experiments two groups of weaned piglets were formed. The first one (I) was without probiotic (control group) and the second one with probiotic in their food. In feed, the probiotic was in the concentration of 0.01%. Measurements were made every 14 days until the body weight of the animals reached 25 kg. The weight of the weaned piglets ranged from 8-25 kg. The average body weight of piglets that took the additive was higher by 1.08 kg.

Keywords: *Bacillus* spp, additive, piglets, weight.

STUDY ON THE EVOLUTION OF PRODUCTION AND PRODUCTIVE PERFORMANCE IN MEAT CATTLE: ABERDEEN ANGUS AND CHAROLAISE IN THE PERIOD 2017-2019 IN THE AREA OF NEAMT COUNTY (ROMANIA)

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Abstract

In this paper we set out to present the results of a study on the evolution of cattle herds and productive performance in the Aberdeen Angus and Charolaise breeds included in the Official Performance Control for meat production, period 2017-2019. For this, information was used from the Associations, accredited for the Official Control of the Performance of Meat Production and for the management of the Genealogical Register for the Aberdeen Angus and Charolaise breeds. The obtained results highlight an ascending evolution of the cattle herds included in the C.O.P. from the two breeds respectively Aberdeen Angus, from 746 heads in 2017 to 1146 heads in 2019, which represents an increase of 53.61%, and for the Charolaise breed, the increase was 53.84%. The herds included in the COP in the Aberdeen Angus breed are significantly higher (93.1%) compared to those in the Charolaise breed (6.9%). Regarding the average daily increase in g / day (smz) compared to the two Aberdeen Angus and Charolaise breeds, the following was found: at the age of 7 months (G200) the Aberdeen Angus breed had the value of 717 g / day, and the Charolaise breed the value of 826 g / day, at 10 months (G300) the Aberdeen Angus breed 982 g / day, and the Charolaise breed 996 g / day and at the age of 12 months (G365), the Aberdeen Angus breed 929 g / day, and the Charolaise breed 1269 g / day. From here, we can conclude that the two breeds obtained results according to the objectives of the breeding program.

Key words: *Neamt, Aberdeen Angus, Charolaise, C.O.P., smz (average daily increase).*

ANTIMICROBIAL RESISTANCE OF STAPHYLOCOCCUS PSEUDINTERMEDIUS

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Abstract

Eleven isolates of *Staphylococcus pseudintermedius* originating from animals were used in this study. Testing was carried out during 2019, and the samples originate from the territory of the city of Banja Luka. For isolation of staphylococci, the standard method of isolation were used, cultivation on blood (5% defibrinated sterile sheep blood) and nutrient agar, with aerobic incubation at 37°C for 24 hours. The sensitivity testing of isolated staphylococci on selected antibacterial drugs was performed by disc diffusion method on Mueller-Hinton agar, by direct suspension of colonies at a concentration 0.5 McFarland, and results were interpreted according to the recommendations of the Clinical and Laboratory Standards Institute (CLSI) from 2008 for oxacillin and vancomycin and from 2014 for penicillin, ampicillin, amoxicillin, cefuroxime, cefazolin, sulfamethoxazole, doxycycline, oxytetracycline, tetracycline, gentamicin, vancomycin, clindamycin, oxacillin, bacitracin, neomycin and streptomycin. The antibiogram discs manufactured by Conda, Proanalysis, were used. To control the performance of this method, we used the reference strain *Staphylococcus aureus* WDCM 00034. Using a disk diffusion test, 100% resistance of the isolates of *Staphylococcus pseudintermedius* was determined on ampicillin, cefazolin, clindamycin, bacitracin, neomycin and streptomycin. All *Staphylococcus pseudintermedius* isolates were multiresistant to six or more antibacterial drugs. *Staphylococcus pseudintermedius* isolates showed no resistance to vancomycin and doxycycline.

Keywords: *staphylococcus, resistance, antibacterial drugs.*

THE EFFECT OF DIFFERENT NEW BEDDING MATERIALS ON AMMONIA EMISSION FROM DAIRY COW SLURRY

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Abstract

Agriculture is the most significant source of Ammonia emission that causes e.g. loss of Nitrogen from agricultural systems. Manure is the main source of Ammonia emissions and causes losses in the nutrient cycles of agriculture as well as local odour nuisance. By using different bedding materials, it is possible to reduce both the Ammonia emissions and to improve the cycling of nutrient. Peat is known as an effective litter material but its use as a virtually non-renewable resource is questionable. Therefore, we need to find new bedding materials to replace peat. In this study, the effect of ten different industrial by-products, reeds and stalks to reduce Ammonia emissions was tested in laboratory in January 2020. Dairy cow slurry and bedding materials were mixed in a volume ratio of 4:1. The Ammonia emission was measured for two weeks once or twice a day. Measurements were performed with a photoacoustic method. The results show that all tested materials reduce the Ammonia emission from the cow slurry used. Interesting new materials to substitute peat are zero fiber and briquetted textile waste. Wheat bran, pellets made of reed canary grass and chopped bulrush had the best effect which is at the same level as that of peat. However, no statistically significant differences between the calculated emission rates were found.

Keywords: *Bedding material, Peat, Ammonia emission, Animal production, Cow slurry.*

EVALUATION OF GENETIC DIVERSITY IN SELECTED BEEF BREEDS

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Abstract

The aim of the study was to estimate genetic drift and gene flow related to population structure and genetic diversity in selected beef cattle. For the evaluation of the genetic drift and gene flow among analysed populations, the Bayesian Population Structure Analysis and software Treemix were used. The genetic analysis included two cattle breeds bred in Slovakia (Charolais and Limousine). In addition to the Limousine and Charolais breeds, other beef cattle (Angus N = 90, Belgian Blue N = 4, Blonde d'Aquitaine N = 5, Hereford N = 98 and Red Angus N = 15) were analysed. The 50k Bead chip was used; the dataset consisted of 34,834 SNPs. To avoid detection bias, SNPs with high linkage disequilibrium ($r^2 = 0.05$) were pruned from the database; the final data set consisted of 296 animals and 2,539 SNP markers. Our results reflected four modes of gene flow between Angus, Red Angus, Charolais, Limousine and Hereford. Analysed breeds were not confirmed to influence genetic make-up of Belgian Blue and Blonde d'Aquitaine populations. All migration edges reached weight values below 0.2. The only two migration edges higher in weight was observed, first between the ancestor of Limousine breed into Blond d'Aquitaine, and second among historical ancestor of Hereford breed into Red Angus. Our results reflect that the donor population has made a significant contribution to the recipient population.

Keywords: *beef, Charolais, gene flow, Limousine, Treemix.*

ANALYSIS OF THE MICROBIOLOGICAL SAFETY OF FEED IN THE PERIOD 2017-2019 IN REPUBLIC OF SRPSKA (BOSNIA AND HERZEGOVINA)

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Abstract

The health safety of feed includes the appropriate chemical composition, sensory characteristics and microbiological safety of feed. The microbiological safety of feed directly affects the health status of animals and their production results, as well as the safety of food of animal origin. The aim of the study was to determine the microbiological safety of feed in the period 2017-2019 in Republic of Srpska (Bosnia and Herzegovina), during which 1,153 samples were tested. Samples were tested for *Salmonella* spp., coagulase positive staphylococci and *Staphylococcus aureus*, *Clostridium perfringens*, total number of microorganisms and total number of yeasts and molds, by test methods BAS EN ISO 6579, BAS EN ISO 6888-1, BAS EN ISO 7937, BAS EN ISO 4833-1 and BAS ISO 21527-2. Samples of feed were tested within self-control (82.15%) and official controls (17.85%). In relation to the Rulebook on microbiological criteria in feed, an average of 26.33% of unsatisfactory samples were identified, of which 97.08% were from self-control and 2.92% from official controls. On average, the highest percentage of unsatisfactory samples of feed was due to the increase in total number of microorganisms (18.86%) and increase in total number of yeasts and molds (16.95%), while the negligible percentage of unsatisfactory samples was due to the presence of pathogens *Salmonella* spp. (0.39%), *Clostridium perfringens* (0.30%) and coagulase-positive staphylococci and *Staphylococcus aureus* (0.08%).

Keywords: *feed, microbiological criteria, safety, Bosnia and Herzegovina.*

ENDOSCOPIC STUDY OF UPPER RESPIRATORY TRACT DISORDERS IN HORSES

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Abstract

Anomalies of the upper respiratory tract are common problem in sport horses and often lead to processes of obstruction resulting in poor athletic performance and respiratory noise during exercise. The aim of the present study was to explore by endoscopic examination the upper respiratory tract in horses with difficulties in breathing and to clarify the cause(s) for these abnormalities. The present study was conducted with 32 horses presented by 12 stallions, 18 mares and 2 foals by endoscopic examinations of the upper respiratory tract. All the animals had shown signs of different degree of respiratory distress, and some of them gave abnormal respiratory noise during exercise. The animals were of various ages, breed and weights. Most of the horses included in this study have been extensively used for sport purposes. The study of all affected animals showed various abnormalities of the upper airway. The most commonly diagnosed pathology was associated with larynx (recurrent laryngeal neuropathy) and soft palate (DDSP). The other affected areas were pharyngeal zone, palatopharyngeal arch and the trachea. In addition during survey three horses were diagnosed with occult pulmonary hemorrhage (EIPH). Despite the similar clinical signs of respiratory distress and roar manifested by patients, the origin of the problem in to the lung automatically put these animals beyond the scope of this study. There are a large number of upper respiratory tract disorders in horses. Their exact diagnosis can be achieved only by direct visualization through endoscopy.

Keywords: *horses, upper respiratory disorders, endoscopy.*

DETECTION OF *SALMONELLA* INFECTION IN BROWN RAT (*RATTUS NORVEGICUS*) ON PHEASANT FARM

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Abstract

Bacteria belonging to the genus *Salmonella* are significant cause of food poisoning in humans, and may also cause serious disease in poultry, and thus in pheasants. The most important serovars for the health of pheasants belong to the species *S. enterica*. One of the reasons for the presence of *Salmonella* on pheasant farms is the presence of infected rodents, primarily brown rats (*Rattus norvegicus*) in the holding yards and in the interior of farm buildings. The brown rat through secretions and excretions excretes *Salmonella*, which usually per os enters the digestive tract of pheasants and begins infection. In order to assess the risks of the presence of brown rats in a pheasant farm from the point of introduction of *Salmonella* in farm, we organized this experiment with the aim of capturing and detection of the presence of *Salmonella* in brown rats. The experiment was organized in the pheasant farm in April and May using specialized rat traps. During the experiment 35 specimens of brown rat were trapped. Control of specimens for the presence of *Salmonella* ascertained the presence of *S. enterica* subsp. *enterica* serovar *Enteritidis* in 7 specimens (20.0%).

Keywords: *Salmonella*, infection, *Rattus norvegicus*, pheasant, pheasant farm.

STUDY IN VITRO OF HONEY AND ROYAL JELLY AGAINST ENTOMOPATHOGENIC BACTERIA ISOLATED FROM *VARROA DESTRUCTOR*

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Abstract

Many authors have reported studies on antimicrobial effect of honeybee products against clinical microorganisms, but to our knowledge, there is no data about the activity against entomopathogenic bacteria isolated from honeybee pest, *Varroa destructor*. Use of chemical acaricides such Fluvalinate and Flumethrine are harmful to bee populations and leaves the residues in honey. Recently, the use of biological agent (*Beauveria*, *Metharizium*) and bioproducts have shown convincing and satisfactory results in biological control. The aim of this work was to study *in vitro* effect of honeybee products (honey and royal jelly) against bacteria (*Bacillus* sp and *Pseudomonas* sp.) isolated from *Varroa destructor*. The products provided from *Apis mellifera intermissa* were collected when the larvae of queen honey bees were 3 days old. The samples were kept frozen at 4° C in dark jars until analysis. For the isolation and identification of the bacteria, the macroscopic and microscopic characters were done according to the Bergey's manual of systematic Bacteriology. Biochemical characteristics were tested by using API 20E galleries (Biomerieux). To test this activity, the agar diffusion method is used. The bacterial isolates were incubated at 37 ° C for 24 h. As a control, we used distiller water. All experiments were made in triplicate and means \pm standard deviation were presented. The results obtained show that the honeybee products inhibit the growth of *Bacillus* sp. compared with *Pseudomonas* sp. but royal jelly exhibited the strength activity. The ectoparasite is the vector of many pathogenic agents, which accelerates the death of bees.

Key words: antibacterial activity, honeybee products, bacteria, *Varroa destructor*, honeybee.

THE INFLUENCE OF THE AGE OF LAYING HENS ON THE DAILY FEED CONSUMPTION PER LAYING HEN AND EGG

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Abstract

Feed consumption is one of the most essential parameters of the poultry production, because the costs of nutrition often make over 60% of the total cost. Today's light line hybrids, selected for the production of eggs for consumption, realize exceptional conversion of food to egg mass. From an economic point of view, the information about feed consumption per product unit, i.e. produced egg, is more interesting in relation to the daily consumption of food per laying hen, which is not the best indicator of economic production. Since it has been established in the area of the Balkans, that commercial flocks in the production of the eggs are held to the end of the 72nd week of age as a final instance in the production, the aim of this paper is to examine what is going on with feed consumption per hen, and produced egg, before, as well as, after established 72nd week of age, up until the end of the 79th week of age of hen hybrids Lohmann Brown, where the production period lasted 61 weeks, which is 427 days. The examinations were performed on the light line hybrid Lohmann Brown by conducting appropriate experiment on the laying hens' farm "Agrovet" in Foča municipality, Bosnia and Herzegovina – Entity of Republic of Srpska. During the research, the following basic indicators were tested: food consumption (daily per laying hen and per produced egg) by weeks and for the entire production cycle. We also determined the coefficients of phenotype correlation between the age and daily feed consumption per laying hen, or per produced egg. By calculating the phenotypic correlation between the age of laying hens, and the daily feed consumption per laying hen and produced egg, it can be concluded that, in the present case, it is justified to use laying hen in the production of eggs for 61 weeks. Viewed as a whole, it can be concluded that the analyzed commercial flock of light line hybrids Lohmann Brown, in most tracked production indicators has achieved satisfactory results which values are mostly within the limits of the values to the technological standards predicted by selector.

Keywords: *eggs for consumption, feed consumption per laying hen, feed consumption per produced egg, correlation.*

DETERMINING CAPACITY OF RESCUE DOG TEAMS

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Abstract

Besides technological possibilities, dogs are used to find missing persons in disaster situations resulting from explosions or natural hazards: earthquakes, floods, landslides, fires, etc.. Search and rescue dogs - are able to find people who are hiding for various reasons, people with psychological problems and elderly people with Alzheimer's disease. Turkish Disaster and Emergency Management Presidency (AFAD) as an official association has a leading role in the training and use of search dogs in Turkey. For this purpose, AFAD has formed several rescue dog teams in İstanbul, Ankara, İzmir, Bursa, Samsun, Erzurum, Adana, Van, Diyarbakır, Afyonkarahisar and Sakarya. Search and rescue personnel and veterinarians work in these teams. This study was aimed at determining the capacities of AFAD rescue dog teams by means of a survey. The survey was carried out with the staff involved in the search and rescue operations.

Keywords: *Rescue Dog, Turkey, capacity.*

DETECTION OF SELECTION SIGNALS IN CATTLE POPULATIONS BY PRINCIPAL COMPONENT ANALYSIS (PCA)

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Abstract

The presented study provides a genome-wide scan of selection signals in cattle by principal component analysis (*PCA*). The aim was to identify SNP affected by intensive selection based on package *PCAdapt* implemented under software *R*. This analysis provided insight into the association between the SNP frequencies related to population differentiation. The four cattle populations were involved in the analysis (Slovak Spotted cattle, Ayrshire, Swiss Simmental and Holstein) with overall 272 of genotyped individuals. After applying quality control, the final dataset consisted of 35 675 SNPs, with an overall length of 2496.14 Mb and average space between adjacent SNP 70.03 ± 76.1 kb. After performing *PCA* analysis, the uniqueness of the breeds was revealed. On the other hand, a close genetic relationship and eleven SNPs affected by selection were found, with a position close to 162 genes involved in the various biological processes. The majority of genes were involved in the positive regulation of adenylate cyclase activity, embryo development and somatic diversification of immune receptors via somatic mutation. Several candidate genes for genetic control of the immune system (*DNAJB9*), muscle development (*SEPT7*, *TRIM32*, *ROCK1*, *NRAP*, *PZDZ8*, *HSPA12A* and *FGFR2*), milk production (*SOCS5*, *CD46*), reproduction (*LHCGR*, *EEPD1*, *FSHR*) and coat colour (*KIT*) were identified. Our results provide insights into the regions of the genome affected by the intensive selection of analysed cattle populations.

Keywords: *biological process, Bos Taurus, footprints of selection, PCAdapt, production traits.*

THE INFLUENCE OF SILAGE DIETS ON THE OF FATTY ACID CONTENT IN MILK FAT

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Abstract

The overview of the investigations with influence of diets with silage on the content and ratio of fatty acids in milk fat was given in this paper. Because of the high significance of animal fats on human health, during the recent decades the attention has been given to the content and ratio of fatty acids in milk fat. Milk fat is especially important because it is obtained without animal sacrifice. Among other factors (breed, lactation phase, gravidity, seasonal variations) the significant influence on the milk fat content can be achieved with the diet, particularly with the ratio of forage and concentrate feeds, and also with the physical effectiveness of dietary fiber. The most favorable ratio and highest content of polyunsaturated fatty acids in milk fat can be fulfilled when animals are fed on pasture or with green forages. However, such feeding regime is limiting the genetic potentials in high yielding breeds and that is the reason why diets are mostly composed with conserved and concentrate feeds. Various types of silages are particularly important for economical milk production, but they have different influence on the content and ratio of fatty acids in milk fat (depending on plant species and vegetation phase). Maize silage, which is most often used in our country, produces increased content of saturated (and undesirable) fatty acids, to a greater extent than any other silage type.

Key words: *milk fat, fatty acids, feeding, silage.*

IMPACT OF PARENT FLOCK NUTRITION ON PHEASANT CHICKEN MORTALITY

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Abstract

In the experiment, mortality of white ring pheasant chicken has been researched, on two pheasant farms during the period from 2016 to 2018. During non reproductive season, the parents flock in pheasant farm „I“ was fed with grain mixture, and in pheasant farm „II“ whole diet feed mixture with 18% crude protein (CP) (October/January) and whole diet feed mixture with 20% CP (February – March) were used. But, during reproduction period the parent flocks in both farms used mixture with 22% CP. During rearing period, pheasant chickens in both pheasant farms were fed with whole diet feed with 28% CP in starter phase, and during grower phase they used mixture with 24% CP. In pheasant farm „II“ vs. pheasant farm „I“ the mortality of pheasant chickens in 15 days age was 2.87% : 2.70%, in age of 16-26 days 0.79% : 0.74%, and in age of 26 to 42 days 0.25% : 0.33%. Not significant lower total mortality of pheasant chickens on pheasant farm „II“ till 42nd day of age was determined compared to pheasant farm „I“, 3.91% vs 3.77%. Based on results it could be concluded that nutrition with whole diet mixture during non reproductive period allowed the creation of better body reserves, and thus achieving better production results of parents flock (approved in previous experiment) as well as lower (not significant) pheasant chicken mortality.

Key words: *pheasantry, breeding flock, pheasants, nutrition, mortality.*

ANALYSIS OF MORPHOMETRIC PARAMETERS DUCK EGGS OF LOCAL BREED SHAOXING

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Abstract

The efficiency of industrial poultry farming within the optimization of poultry technology, depends on the level of genetic potential of the flock. Selection features of Shaoxing ducks make this kind optimal for its breeding in the People's Republic of China. The study aims to evaluate the morphometric characteristics of Shaoxing duck eggs, which are bred on the breeding farm of Zhejiang Generation Biological Science and Technology Co., Ltd in Zhuji, Zhejiang Province, China. The weight, length, width of the eggs and the index of the egg shape have been determined. An individual method of counting the number of eggs laid by ducks of the Shaoxing breed for 4 adjacent months has been implemented. The average weight of the egg is 67.45 ± 0.22 g with limit values $\lim \max = 89$ g $\lim \min = 45$ g. The average value of egg length is 6.02 ± 0.01 cm, width – 4.45 ± 0.01 cm. The duck egg shape index is 74.01 ± 0.12 . Thereby systematic individual studies of morphometric parameters of eggs will increase the effect of selection by expanding the indicators of lifelong assessment of the uterine population of ducks. Selection of queens for the breeding core of the breed according to the indicators of manufacturability of morphometric parameters of eggs will increase the incubation yield of ducklings and, accordingly, will be one of the effective mechanisms to ensure economic profitability of breeding Shaoxing ducks.

Keywords: *Duck, eggs, weight, genetic potential, breed.*

INFLUENCE OF MILK FAT CONTENT ON THE PROPERTIES OF FULL FAT YOGURT

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Abstract

In the last couple of decades, full fat yogurt has been produced and consumed in Serbia not only as a stirred, but also as a Greek-style yogurt. Milk fat (MF) content of these products varies in a wide range from 2.8-3.2% in stirred yogurts to 8-9.7% in Greek-style yogurts. In addition to the physico-chemical characteristics, milk fat has a great influence on the rheological and sensory properties of yogurt. Thus the aim of this work was to investigate the influence of milk fat on the above mentioned yogurt characteristics. As expected, due to significantly higher MF content, higher levels of total solids (17.80-20.00%) were detected in Greek-style yogurts. Furthermore, the highest protein content (6.92%) was also recorded in yogurt with 8% MF. Higher total solids in Greek-style yogurts influenced stability of casein gel structure so in these samples syneresis was not detected. Also, significantly higher ($p < 0.05$) values of viscosity were recorded in Greek-style yoghurts. On the other hand, lower MF content and subsequently lower total solids in stirred yogurts influenced lower viscosity and occurrence of syneresis (12.47-22.09%). The taste had the greatest influence on the overall sensory quality of the yogurt. Greek-style yoghurt samples showed significant difference ($p < 0.05$) in terms of average taste rating and pondered mean value. However, although not rated as the best regarding taste, yogurt with 9% MF had the highest percentage of maximum quality - 94.33%. Stirred yoghurt samples did not differ significantly in any parameter of sensory quality and for those samples percentage of maximum quality was in the range 84.94-85.14%.

Key words: *full fat yogurt, viscosity, syneresis, sensory quality.*

COMPARISON OF WRAPPED BALE SILAGE AND EARLY CUT HAY OBTAINED FROM THE SAME OAT-RYEGRASS FIELD ON PERFORMANCES OF DAIRY EWES IN EARLY LACTATION

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Abstract

The aim of this work was to evaluate the effect of different forage types with very similar chemical composition on productive performance of Sarda dairy ewes in early lactation. At 50 d after parturition and for 30 d, 24 adult sheep were allocated to two dietary treatments: SILAGE (S) and HAY (H). The diets contained alfalfa hay, corn, barley, soy and either oat-ryegrass wrapped bale silage (DM 35%; DM basis: 61.7% NDF, 8.2% CP) for the S group or oat-ryegrass early cut hay (DM 83.8%; DM basis: 60.2% NDF, 10.0% CP) for the H group, both obtained from the same field. The diets had (DM basis) 41.2% NDF, 17.4% CP for the S group and 41.1% NDF, 17.5% CP for the H group. Early lactating Sarda ewes showed higher group dry matter intake when fed S diet (DMI; 2.60 vs 2.21 kg/d, for S and H groups, respectively). However, milk production (1.76 vs 1.71 ± 1.08 kg/d), fat-corrected milk (FCM, 1.65 vs 1.58 ± 0.12 kg/d) and net energy for lactation (NEL, 1.70 vs 1.63 ± 0.12 Mcal NE/d) did not differ between the two groups, even though the values tended to diverge, in favour of S. Milk composition was not affected by the dietary treatments, except for milk lactose (P=0.011) and milk urea (P=0.009), which were significantly higher in the H group. In addition, BW and BCS did not differ between the two groups, even though BW was increasingly higher in the S group. In conclusion, despite the lack of significant differences, the use of wrapped bale silage induced higher DMI intake and a tendency of milk production and BW to be progressively higher compared to the group fed the hay-based diet. This pattern could be linked to differences between the two forage types in their fiber degradation rate.

Keywords: *Fiber quality, haylage, dairy sheep, forages.*

EFFECT OF PROTEASE ADDED IN FOOD ON CHICKEN CARCASS QUALITY

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Abstract

This study evaluates the effect of protease-supplemented diets containing different crude protein levels and sex on the weight and percent yields of individual meat classes (class I meat: breast, drumsticks and thighs; class II meat: wings, and class III meat – back and pelvis) in Master Gris broilers (medium-growing strains). Chickens were fed maize-and-soybean-based diets. The fattening period lasted 49 days. Broilers were allocated to 3 dietary treatment groups: group C (standard diet, 0% protease), group E-I (0.2% protease, crude protein level reduced by 4% compared to C) and group E-II (0.3% protease, 6% reduction in crude protein compared to C). Results showed that no significant differences were observed in the weight of class I and class II meat between dietary treatments ($P>0.05$). Reduction of crude protein by 4% in diets supplemented with 0.2% protease affected the weight class III meat in male chickens ($P<0.05$). The feeding treatments did not influence the percentage of class I and class III ($P>0.05$), while significant differences were observed in percentage of class II meat (between male broilers in C and E-I groups, $P<0.05$). The effect of sex was significant on both weight and percentage of all three meat categories ($P<0.05$).

Keywords: *broilers, protease, sex, class meat.*

APPLE POMACE UTILIZATION IN FATTENING PIGS DIET – EFFECT ON PRODUCTION PERFORMANCE AND CARCASS QUALITY

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Abstract

Apple pomace is a by-product of apple juice production and a rich source of carbohydrates, crude fibre, minerals and polyphenols. In line with the global tendency of reducing and reusing waste and food by-products, the aim of this research was to determine the effect of feeding diets containing dry apple pomace, on production performance and carcass quality of fattening pigs. The research included 40 crossbred pigs (Swedish Landrace x Large Yorkshire), assigned to 2 dietary treatments (20 animals per treatment). In the first dietary treatment – T1, pigs were fed conventional diets, containing 16% crude protein in the first fattening phase (25 – 60 kg body weight) and 13% crude protein in the second fattening phase (60 -100 kg body weight). In the second dietary treatment - T2, pigs were fed diets with the same protein content as in T1 treatment, supplemented with 7% and 10% dry apple pomace during the first and the second fattening phase, respectively. Standard pig fattening technology was applied. Results of the experiment have shown that apple pomace addition in fattening pigs' diets did not have negative effect on production performance and carcass quality, i.e. final body weight (T1: 100.10 vs. T2: 100.90 kg), average daily gain (T1: 0.585 vs. T2: 0.588 kg), feed conversion ratio (T1: 3.46 vs. T2: 3.48), dressing percentage (T1: 81.24 vs. T2: 80.83%), rump back fat thickness (12.50 vs. 12.95 mm) and meatiness (T1: 58.38 vs. T2: 57.69%). Based on the obtained results, it can be concluded that dry apple pomace can be used as a feedstuff in diets for pigs, as a substitute for other nutrients and thus contribute to environmental protection and conservation of natural resources.

Keywords: *apple pomace, by-product, fattening pigs, feed.*

INVESTIGATION ON GUMBORO DISEASE IN SOME POULTRY FARMHOUSES IN THE NORTH OF ALGERIA

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Abstract

A survey on Gumboro disease was carried out in a few poultry farms located in the region of Blida and Chlef in the north of Algeria. The information was gathered from 15 practicing veterinarians. 67% of vets surveyed said they have encountered cases of Gumboro disease. The farm most affected was flesh chicken (93%). The age group between 14-28 days (growth phase) was the most affected. Symptoms of a digestive nature were the most common, in fact, 100% of veterinarians observed signs of atrophy or hypertrophy of the Fabricus bursa, 80% of whitish diarrhea and 73% of severe depression. Haemorrhagic and edematous lesions in the bursa (100%) and muscles (87%) were the most observed, followed by the same lesions in the kidneys (27%) and liver (13%). 80% of veterinarians said the morbidity rate was between 25% and 50%, while 100% believed that clinical manifestations were always accompanied by mortality. Vaccine failure is the main cause of the disease with a rate of 80%. The diagnostic method was based in 93% of cases on clinical signs, while laboratory diagnosis was used less (20%). Despite the vaccination protocol being followed by all vets surveyed, 47% said there was a relapse after vaccination. The investigation showed that Gumboro disease is still a problem for poultry farming despite routine vaccination, which may indicate vaccine failures in the field. There are many factors that contribute to the worsening of viral infections, however, the damage could be limited by improving husbandry conditions.

Keyword: *slaughterhouse, offal, carcass, reasons for seizure.*

THE MAIN REASONS FOR SEIZING OFFAL AND MEAT FROM SHEEP AT THE SLAUGHTERHOUSE OF MOSTAGANEM IN WESTERN ALGERIA

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Abstract

Sheep meat and offal are considered nutritious and essential for food, meat produced in general is subjected to an inspection by the veterinary services before its marketing, the fundamental purpose of which is the protection of public health and the guarantee of quality to consumers. Our work was carried out at the Mostaganem slaughterhouse in western Algeria, to detect and identify the dominant lesions on carcasses and offal in the slaughtered sheep species and to assess the extent of the resulting losses. A total of 559 animals were slaughtered and inspected, of which 69 (11.59%) carcasses were infested with various lesions and were subject to seizure. Cysticercosis represents the most dominant pathology with 21.73%, followed by multiple abscesses on the liver (17.39%), hydatitosis (11.59%), pulmonary pleurisy (10.14%), pulmonary aillotage and hepatic steatosis (8.69% for each), carcass abscesses (7.34%), hepatization of the lung (5.79%), pulmonary emphysema and pericarditis (2, 89% for each) and finally tuberculosis and fascioliasis (1.44% for each). The liver was the most seized organ with a percentage of 52.17%, followed by the lungs (37.68%), then the meat at the neck (7.24%) and finally the heart (2. 89%). These results show that the reasons for seizing meat and sheep offal are of various origins with the predominance of lesions of parasitic origin. We hope that this work paves the way for further study to help fight the diseases causing these losses in order to safeguard the national economy and ensure social well-being.

Keyword: *slaughterhouse, offal, carcass, reasons for seizure.*

A QUANTITATIVE TYPOLOGY FOR CAPTURING THE DIVERSITY OF MANURE AND SEWAGE MANAGEMENT: A CASE STUDY IN CHINA

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Abstract

As the rapid development of intensive animal husbandry industry, vast amounts of wastes are generated, of which, the main contributor to cause huge potential impacts on environment is manure, along with sewage (including feces, urine and wastewater). However, a high diversity exists in manure and sewage management (MSM) and has rarely been classified at a scientific and statistical level, thereby leading to complexity and difficulty in policy and sustainable evaluation. Concerning this issue, this study attempted to establish a quantitative typology to simplify MSM diversity. Taking Chinese dairy MSM strategies for example, we explored a MSM typology using the nationwide survey of 306 scale dairy farms in China. Seven well-known categorical clustering algorithms were implemented. The validation of clustering performance, i.e., clustering tendency analysis, six internal cluster validity indices and ranking method, were also conducted to recognize meaningful clusters and determine a suitable clustering algorithm contributing to reflect the real data structure. The clustering tendency analysis indicated the data highly clusterable with significant clusters. Furthermore, the ranking results showed that COOLCAT algorithm obtained the local optimal clustering performance and cluster number was verified to be four. Correspondingly, Chinese dairy MSM strategies were classified into four representative types based on six MSM variables involving various technologies or practices in collection, storage, processing and application stages. The typology we established could rapidly select representative types, deliver the outcomes to stakeholders straight forwardly, and make the best use of all available information. More importantly, it could capture the diversity of MSM strategies at national level, and support the mathematical-modelling evaluation of policy and sustainability at a higher scale.

Keywords: *Typology, Manure and sewage management, Categorical clustering analysis, Clustering validation, Data-mining.*

HOW MUCH MEAT DO WE ACTUALLY EAT? AN ESTIMATION OF THE LOSS-ADJUSTED CONSUMPTION OF MEAT IN GERMANY

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Abstract

Because of various negative effects on the environment, health and animal welfare, meat consumption is on everyone's lips. Despite this, the statistical basis for the level of "consumption on the fork" or rather the level of loss-adjusted meat consumption, is subject to uncertainties. This is also true for Germany as the statistical method for calculating loss-adjusted meat consumption using fixed coefficients is based on estimations that have not been updated since they were first applied in 1989. Evidence from a representative national household survey indicated a per capita meat consumption of 42kg for Germany in 2007. The application of the coefficient, on the other hand, leads to a consumption level of 60kg, which has been at this level for years. The discrepancy of the two results indicates an overestimation of meat consumption using a 30-year old coefficient. Against this background, it is the objective of this study to estimate the loss-adjusted meat consumption for pork, beef, and poultry meat. The estimation is based on a material-flow-analysis including production data, distribution channels and losses along the value chain at seven different stages. Initial results show a slight reduction of the consumption level for pork of 6.16% compared to the old calculation, whereas the consumption level for beef and poultry has slightly increased by 16.16% and 14.49%.

Keywords: *Loss-adjusted meat consumption, material-flow-analysis, international comparability.*

POTENTIAL USE OF MIRTUS COMMUNIS BY-PRODUCT IN SHEEP DIET

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Abstract

The use of agricultural by-products in animal nutrition is a known strategy to reduce food lost and feed costs. In the recent years this practice has become compulsory to meet the sustainability requisite of the productions. The exhausted myrtle berries (EMB) of *Myrtus communis* L., are a by-product obtained after the production of the characteristic myrtle liqueur typical of Sardinia (Italy). Its use in ruminant nutrition could represent an alternative for their problematic management and disposal. Moreover, this by-product contains moderate concentrations of polyphenols, which might have beneficial effects on the rumen metabolism of protein and fatty acids (FA). In order to investigate its potential use in sheep nutrition, and the effects on rumen metabolism, 11 weeks trial (3 and 8 weeks of adaptation and experimental periods, respectively) was carried out. Twenty-four Sarda dairy sheep were allocated to three treatments: a control group (CON), two groups supplemented with 50 g/d (EMB50) or 100 g/d (EMB100) per head of EMB. Analyses on blood, milk and rumen liquid were carried out. No negative effect on animal health was revealed. Milk yield decreased with the higher dose of EMB. Milk and blood urea, and rumen ammonia were reduced by the EMB at both doses. Weak effects on milk and rumen FA composition were observed, except for the rumen CLA_{cis-9, trans-11} and total CLA concentrations that increased in EMB50 and tended to increase in EMB100 compared with CON. The abundance of *Butyrivibrio* group was reduced by both doses of EMB. Overall, the EMB can be advantageously included, at moderate doses, in the diet of lactating ewes, being particularly useful in improving nitrogen utilization.

Keywords: *By-products, Fatty acids, Microorganisms, Nitrogen utilization, Polyphenols.*

Acknowledgments: Thanks to Cargill srl (Animal Nutrition Division) for providing the feed ingredients.

EFFECT OF SPACE ALLOWANCE ON BEEF CATTLE PERFORMANCE AND HEALTH

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Abstract

A low space availability for finishing cattle could compromise animals' health, welfare and growth. The aim of this study was to investigate on how space allowance can affect health and growth of finishing Charolais bulls housed in an indoor facility. The trial involved 108 bulls with an initial individual space of 3.50 or 4.37 m² per animal, for the low (LSA) or the high space allowance group (HSA), respectively. For each animal the health conditions were collected daily and the average daily gain (ADG) was measured throughout the trial. Data on ADG were analyzed through a mixed ANOVA model, whereas data on symptoms and treatments were analyzed through the non-parametric Kruskal-Wallis test. Because of an unexpected culling rate due to lameness, the space allowance increased throughout the trial up to 4.07 and 4.62 m² per animal for LSA and HSA, respectively. Average daily gain was not affected by space allowance and was on average 1.28 Kg/day, but LSA led to a higher number of treatments per sick animal (1.23 vs. 2.60, P=0.011). This study shows how higher space allowance in finishing bulls can help in improving animal health in indoor systems.

Keywords: *Charolais, Lameness, Stocking density, Growth.*

AUTOMATED SYSTEM FOR BEE COLONY WEIGHT MONITORING

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Abstract

Real time, continuous and remote monitoring of the honeybee colonies with application of information and communication technologies (ICT) is becoming increasingly frequent in industry and in a scientific research. Combination of ICT and beekeeping led to the development of the Precision Beekeeping approach. Successful implementation of the Precision Beekeeping system includes development of the bee colony monitoring hardware solution and computer software for data collection and further analysis. This paper describes developed and implemented bee colony monitoring unit for weight and temperature monitoring. Bee colony weight is one of the key metrics of the strength of a colony. Changes in weight can reflect the productivity rate of the colony, as well as its health and state. Developed monitoring system is based on Raspberry Pi Zero W single board computer with several connected sensors for bee colony temperature and environmental parameter monitoring. Weight is measured using single point load cell with possibility to measure weight up to 200kg, which is enough for the beehive measurements. Data transfer from the remote bee colony is provided by the external 3G router. For data storage and analysis cloud-based data warehouse is developed. Collected data is accessible in the web system with user friendly interface for data visualisation and reporting. Within this research scale calibration process is described and accuracy of the weighting is evaluated and possible challenges are discussed. Described monitoring system is developed within the Horizon 2020 project SAMS, which is funded by the European Union within the H2020-ICT-39-2016-2017 call. To find out more visit the project website <https://sams-project.eu/>.

Keywords: *Precision Beekeeping, Precision Apiculture, weight monitoring, bee colony monitoring, SAMS project.*

ADAPTIVE PRACTICES OF LIVESTOCK BREEDERS TO CLIMATE CHANGE IN MOROCCO'S ARID RANGELANDS

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Abstract

Climate change (CC) is a reality and a serious challenge in the pastoral ecosystem of the high plateaus of eastern Morocco, because since the end of the 70s, this area has experienced proven manifestations of CC such as a significant decrease in rainfall and an increase in droughts' frequency. Accordingly, small ruminant rearing, major livelihood, has become more vulnerable due to its overreliance on climatic conditions. This study aims to exam the adoption by livestock breeders of adaptation practices in the face of climate change, taking into account the differences in wealth status in terms of the size of the sheep flock held, as well as to determine the factors influencing their implementation. Data were analyzed using descriptive statistics, Kruskal-Wallis test and multiple linear regression. Almost half of the breeders belong to the group of low adopters of adaptive strategies toward CC. There are significant differences (Chi-square = 48.90, $p < 0.001$, $df = 2$) between breeders' categories in terms of total number of adaptation practices implemented and that these are due to a very significant dissimilarity between small herders on the one hand and large and medium breeders on the other. Regression results indicated a strong relationship between the total count of adaptation measures embraced and predictor variables ($F(8, 156) = 30.91$, $p < 0.001$, $R = 0.783$, $R^2 = 0.613$). The significant factors are: size of the sheep flock, equipment, ancillary activity, heavy rains perceived, temperature change perceived and agroecological site. It is therefore suggested to target small-scale breeders as a priority and provide an affordable equipment and improved climate information in future programs aimed at strengthening local-level adaptation to CC.

Keywords: *Climate change, Adaptation, Livestock breeders, Rangelands, Morocco.*

GENES RELATED TO THE COAT COLOR IN ALPACAS

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Abstract

The objective of the present study was to molecularly characterize candidate genes of white, black, brown and gray coat color in alpacas. A total of 26 candidate genes for color were amplified in 379 alpacas, 3 guanacos, 5 llamas and 9 vicuñas with 11 polymorphisms found in the MC1R gene (137744G>A, 127299G>T, 137525G>A, 138519A>G, 137712C>T, 137686A>G, 1277325C>G, 126290G>A, 138686G>C, 138563T>C, 138269T>C), 2 polymorphisms in the DCT gene (1929946T>C, 1929904C>CAATTCAGG), 2 polymorphisms in the ASIP gene (10005163T>C, 10009017C>T) 4 polymorphisms in the IRF4 gene (17381093C>T, 17381207T>A, 17381056G>A, 17381168G>GC), 1 polymorphism in the KIT gene (5860389G>A), 1 polymorphism in the TYRP1 gene (6745256C>A), 1 polymorphism in the KITLG gene (6745256GA>G) and 1 polymorphism in the STX17 gene (2995326AGAGAG>A). Our work has allowed us to study in depth the pigmentation of the alpaca in a simple and complete way, thanks to the sequencing of the genome of the alpaca and we have identified not 2 genes that had been studied for the color of the alpaca until now, but a list of 7 genes responsible for coat color in white, black and gray alpacas.

Keywords: *Coat color, coat genes, alpacas.*

THE MERTOLENGA CATTLE BREED EXPLOITED IN THE MONTADO SYSTEM

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Abstract

Beef cattle production is an important component of sustainable agriculture in vast regions of Europe, ranging from maintaining the rural landscape to genetic preservation. Among the investigation topics covered are the various existing systems that arise as a result of the different uses of the same landscape. In Portugal, the “montado” system despite having a lot of bibliography dedicated to its ecology and landscape value, does not have much information gathered about the cattle holdings that use it. Such systems are characterized by the use of the herbaceous substrate under cork or holm oak, in strong integration with agricultural systems that produce cereal grains, straw and stubble, in addition to the production of hay and silage. In this perspective, the “montado” is a highlighted system, since its sustainability has been verified for centuries; however, with regard to its use by cattle, the information gathered is still insufficient and the economic efficiency of its farms is globally little known. The Mertolenga cattle breed withstand the most severe climatic conditions, being therefore explored in “montado” systems completely in the open, being one of the most representative breeds of this type of system. Being a small breed, it has lower energy maintenance needs, but with sufficient milk capacity to offer milk to the calves until weaning even when used in an industrial crossing. Another advantage over the larger and heavier breeds is the greater number of normal heads per hectare of grazing due to lower feed requirements.

Key words: *Cattle, Silvopastoral, Mediterranean, Pastures, Systems.*

INFLUENCE OF SWEET CHESTNUT HYDROLYSABLE TANNINS ON SKATOLE CONCENTRATION IN *COLON DESCENDENS* AS IMPORTANT COMPONENT FOR APPEARANCE OF BOAR TAIN IN BOARS

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Abstract

Factors related to nutrition, especially certain diet ingredients, were shown to affect the compounds responsible for boar taint, namely skatole. Skatole is one of the two main compounds of boar taint. It is produced in the large intestine by bacterial degradation of amino acid L-tryptophan and after absorption, it is transported to the liver, where it is metabolized mainly by cytochrome P450 (CYP450) enzymes. Tannins are water-soluble polyphenols with varying molecular weights. They are chemically classified as hydrolysable or condensed tannins and are both considered to have either adverse or beneficial effects depending on their concentration and nature. The aim of the paper is to present the effect of different levels of inclusion (up to 3%) of sweet chestnut hydrolysable tannins on chemical traits, skatole and indole concentration of intestinal content of colon descendens (CD) of entire males (EMs). Authors reported that different supplement of hydrolysable tannins reduce skatole and indole concentration in large intestine, especially in CD. Trials were carried out on crossbred (Large White × Landrace) and Swiss Large using mixed feed for growing and finishing period of raising with different inclusion of hydrolysable tannins (HTs) from 1-3%. Results showed constant reduction of intestinal skatole concentration in boars, from control to 3% group. Significant effect of tannin supplementation was also observed on nitrogen content in DM; as it was significantly higher with 2% and 3% than control group. Similar trend, although not significant, was reported for nitrogen content of wet matter. Ammonia content was reduced with tannin supplementation, but the difference was significant only between control and 1% supplemented group. No effect of tannin supplementation was observed on pH and indole content. Studies also reported that EMs supplemented with 3% of HTs positively affect proportion in intestinal bacterial flora of *Oscillospira* genus, Ruminococcaceae family, reduce amounts of Lactobacillales order, Streptococcaceae and Veillonellaceae families in the microbial ecosystem. The present findings suggest positive effects of tannins to decrease skatol concentration in intestinal content, as important component for appearance of boar taint in boars.

Keywords: *skatole, indole, large intestine, hydrolysable tannins, boars.*

LABVIEW BASED REAL-TIME EGG YOLK COLOR TONE MEASUREMENT SYSTEM

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Abstract

As an agricultural product, the egg has great importance on human nutrition. However, the yellow part of the egg provides us with important information about the quality of the egg. One of the factors associated with this important biophysical limit and egg quality is defined as the color tone of the egg yolk. In current practice, the method generally used to determine the color tone of the egg yolk is to compare the egg yolk with a standard color fan. This fan includes 15 color tone stripes, starting with the extremely light yellow and ranging from orange to red. Color tones can be expressed by the number on the strip. With these observations, information about the chemical and physical properties of egg yolk can be obtained, but the factors may affect from a light source (frequency and power) and this environmental condition also affect the observer's capacity to see the true color tone. The tone and thickness of the egg yolk are among the important clues evaluated in terms of customers and food quality. If the color of a food is different from what we expected, at this point we almost certainly reject it for another option. As a result, color tone is an important part of food quality that should not be underestimated. Ongoing research in various nations has confirmed that the yolk tone is one of the fundamental limits of the nature of eggs. While customer understanding of what constitutes a good, tempting egg yolk color tone is mostly linked to the topographical space, culture, and traditions, it is certainly clear that a toned egg yolk that customers want in most parts of the world is significant for marketing. For this reason, in the study, a LabVIEW software was developed based on a standard color fan and a method presented that eliminates the illusions of human perception and environmental effects were tried to be presented.

Keywords: *Egg yolk, Color analysis, Egg yolk classification, Real-time measurement, LabVIEW.*

LABVIEW BASED REAL-TIME COLOR MEASUREMENT SYSTEM

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Abstract

Colorimetry is of paramount importance to the agricultural industry as well as agricultural marketing standards. Colorimetry refers to the processing of agricultural products for consumer needs from a marketing point of view, and therefore the agricultural industry spends a lot of money and time classifying each product. In the past, agricultural professionals had to use program codes that are difficult-to-learn, and even the most basic image analysis for agricultural product classification required mastering different program libraries. Today, the LabVIEW platform offers a flexible, fast, easy-to-learn, and complete image analysis infrastructure with various useful modules. For this reason, in this study, a method analysis for color perception with a simple USB webcam and software developed for real-time color analysis on the LabVIEW platform is presented and its success in the basic color analysis is tried to be revealed. In this way, color measurements of agricultural products can be made efficiently in a short time and can be used for classification purposes according to the marketing standards and consumer needs. The basic application developed for this purpose in LabVIEW v2019 using NI Vision Development Module v19 and NI IMAQ v19 modules. The basic fact that is intriguing about the LabVIEW application is the idea that LabVIEW can only be analyzed with IEEE 1394, which we can describe as costly, and Ethernet cameras that can only be purchased from authorized dealers of National Instruments, but it should be known that these analyzes can be done with USB webcams. For this purpose, the application includes a USB webcam driver that can be stacked seamlessly.

Keywords: *Webcam, Color recognition, Real-time measurement, LabVIEW.*

A META ANALYSIS OF SUBCLINICAL MASTITIS PREVALENCE IN DAIRY CATTLE

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Abstract

In this study, it is aimed to perform meta-analysis of subclinical mastitis prevalence results determined in 204 published studies conducted in the period 1988-2019 worldwide. In the analyses, subclinical mastitis prevalence was determined worldwide. Also, their prevalence was compared regarding continents (Europe, Africa, America, Asia and Oceania), cow breeds (Holstein and crossbreed, Brown-Swiss and crossbreed, local breeds and crossbreeds, buffalo and other), time (1988-1999, 2000-2009 and 2010-2019) and herd size (small, medium and large). Among the studies that met the specified inclusion criteria, 205 were based on cow and 175 on subclinical mastitis data based on udder quarter formed the study material. In these studies, a total of 185,983 head cows and 1,158,754 udder quarters were analyzed. Subclinical mastitis prevalences were compared with subgroup analyses according to continents, cow breeds, time and herd size. Since high heterogeneity was detected among the studies, Random Effect Model (Der Simonian-Laird method) was preferred in the meta-analysis. In the study sample, Egger's linear regression test and funnel plot were used to determine the publication bias. In the results of study, high heterogeneity was detected among cow-based and quarter-based studies worldwide ($Q=15991.9$, $df = 204$, $p<0.001$, $I^2 = 98.7$; $Q = 74207.5$, $df = 174$, $p <0.001$, $I^2 = 99.8$, respectively), and the pooled prevalence of subclinical mastitis of cow-based and quarter-based was calculated as 0.46 (0.43-0.48) and 0.32 (0.30-0.34), respectively. In cow-based subgroup analyses, it has been determined that subclinical mastitis prevalence is high in the Oceania continent (0.72 (0.59-0.83)), in indeterminate and mixed-type breed (0.50 (0.45-0.54)), in the range of 2010-2019 (0.49 (0.45-0.51)) and small herds (0.50 (0.45-0.54)). In quarter-based subgroup analysis, it has been determined that subclinical mastitis prevalence is high in Oceania continent (0.47 (0.29-0.65)), Jersey and crossbreeds (0.52 (0.25-0.78)), 2010-2019 year range (0.33 (0.31-0.36)) and small herds (0.36 (0.29-0.43)).

Keywords: *Meta analysis, Subclinical mastitis, Dairy cattle, World, Continents.*

OCCUPATIONAL ACCIDENTS, DISEASES AND PREVENTIONS AT SMALL RUMINANT HUSBANDRY IN EASTERN ANATOLIA OF TURKEY

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Abstract

The aim of this review is to provide sensitivity about occupational health and safety, accidents, diseases, and musculoskeletal disorders in small ruminant husbandry. Animal production is associated with a variety of occupational illnesses and injuries. In small ruminant husbandry, the most important task in the care-feeding and management of animals falls into workers. Occupational Health and Safety (OHS) has significant economic implication particularly in terms of medical costs and economic productivity losses. The livestock activities in Turkey have been characterized by the different regional applications. The activities of small ruminants husbandry are especially an important source of income for the indigenous people in the Eastern Anatolia of Turkey. The occupational health and safety in livestock production is very important as it is in many other areas. In this paper, it has been discussed the hazards and the risks related to occupational health and safety in small ruminant husbandry. The most common hazards at small ruminant husbandry in Turkey are the ergonomics, the noise, the air conditioning, the chemicals, the occupational diseases, the zoonotic diseases, the animal attacks, the bites, the injuries, the accidents in transport, the psychological stress and, the skin-borne diseases etc. Occupational diseases and accidents that can be encountered by workers have caused the losses of very serious economic and the qualify persons in small ruminant husbandry. Therefore, the precautions related to the occupational health and safety must be taken for workers at the husbandry and the field. In Turkey, it is not possible to say that the preventive measures on the occupational health and safety in small ruminant husbandry are still sufficient. This information has been prepared based on the personal observations and the experiences directly in the local area.

Keywords: *Occupational health, Occupational safety, Sheep husbandry, Zoonotic disease.*

CURRENT SITUATION OF CATTLE HUSBANDRY AND BREEDING POSSIBILITIES IN VAN PROVINCE OF EASTERN ANATOLIA IN TURKEY

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Abstract

The aim of this survey is to put forward the current situation and the potential of cattle husbandry and breeding opportunities in Van province of Eastern Anatolia in Turkey. Livestock activities in Van province of Eastern Anatolia are an important source of income for the local people. However, it can be said that the activities of animal husbandry have stagnated for last years. Even though this is the case, livestock activities and especially cattle breeding are indispensable for indigenous people. Van is one of the most prominent cities of this area in which its public sustain themselves by animal production. For this reason, it is very important to define the condition, potential, and problems of breeding sector especially with respect to the cattle stock in this city. With the inquiry works, results are determined as yield of cattle is low, the number of animals raised are small, possibility of marketing is restricted, breeding condition of animal is inconvenient, technical knowledge is insufficient, membership at the cooperative is incapable, veterinarian service is expensive. Lack of food, especially lack of protein is still basic problem in Turkey. Genetic improvement offers solutions for satisfaction of needs in livestock husbandry. In Van province of Eastern Anatolia, cattle husbandry participates with 2.5% in general livestock production in Turkey with high share. Characteristics of cattle husbandry in Van province are small farms with 2 to 3 cows per farm (80-85% of total number of farms). The most important of native cattle breeds of Turkey is the Eastern Anatolia Red breed. The cow milk from this breed is either consumed by the household as raw milk or processed as herbaceous cheese. As a result, preservation and development of native cattle breeds as a genetic source is very important.

Keywords: *Cattle breeding, Improvement, Traditional breeding system, Van province.*

TRANSHUMANCE ACTIVITIES IN SMALL RUMINANT HUSBANDRY IN VAN PROVINCE OF EASTERN ANATOLIA IN TURKEY

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Abstract

In this paper, the transhumance activities and the production habits of breeders in sheep and goat husbandry have been discussed. This information has been prepared based on the personal observations and the experiences directly in local area. The livestock activities in Turkey have been characterized by the different regional applications. The activities of small ruminants husbandry are especially an important source of income for the indigenous people in Van province of Eastern Anatolia in Turkey. In the highland sheep husbandry, sheep herds are taken to towards the end of the spring the plateaus which are cool and grassy with the drying of pastures and the start of heat. For a period of 3-5 months, sheep remain in control by shepherds in highland. After the weather cools down, highland breeders and sheep return to villages or to their settlements again plain. Sheep herds usually consist of 300 to 500 heads. Sheep herds were formed by gathering business owners with a different number of animals. Sheep herds are taken to the highlands by grazing or by road transport. One of the most important examples of livestock farming is highland small ruminant husbandry in Van province. The pastoralism refers to season stay at the high plateaus for small ruminant production and semi nomadic life. In order to get more abundant products such as milk, cheese, wool and so on, the people of the region have to go to highlands with the arrival of spring animals to find better grazing and water areas. In this province, it is recommended to keep records in order to obtain a sustainable income source from small ruminant husbandry.

Keywords: *Breeding model, Goat breeding, Sheep breeding, Transhumance activities.*

6. RURAL DEVELOPMENT AND AGRO-ECONOMY

MODELLING THE ADOPTION OF IRRIGATION WATER TECHNOLOGY IN MITIDJA PLAIN, ALGERIA

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Abstract

Since 2000, the public authorities have aimed at encouraging the development of water-saving irrigation technologies. However, the rate of adoption of these technologies has remained low in most of these areas in Algeria. This study aims at shedding some light on the potential factors influencing irrigation technology adoption in Mitidja plain (Algeria). It does so by reviewing previous studies done on technology adoption. In the study, technological, economic, institutional factors and human specific factors have been found to be the determinants of agricultural technology adoption. This study seeks to explain the behavior of farm holders towards adopting new irrigation technologies. The modeling of drip irrigation adoption is chosen as a methodological framework. It consists of defining the determining factors of drip irrigation adoption by farmers in Mitidja plain farming land. In this sense, a survey has been conducted randomly on a sample of 120 farmers, taken from the irrigated area of west Mitidja plain Land 1. analysis results showed that the adoption of drip irrigation was influenced by: the type of crop grown, investment cost, subsidy to drip irrigation, education level, age and agricultural extension.

Keywords: *Irrigated agriculture, West Mitidja Perimeter, land 1, Technologies adoption, Drip irrigation, Binomial Logit model.*

SCALE AND SCOPE OF INNOVATIVE AGRICULTURE TECHNOLOGY TO SUPPORT RURAL DEVELOPMENT

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Abstract

Great economic losses, subsequent health issues occur in Pakistan and surrounding countries due to aflatoxin contamination of food/maize/cereals. In this regard, mobile-drying lines (drying tunnels trolley type units) have been developed at the site (in the house) use in potential post-harvest aflatoxin contamination with a cost of 0.70 \$/bag at farming/loss areas for food-safety. By use of this mobile technology grain moisture is reduced up-to 14%. Thus, minimized loss ratio, the involvement of multiple-technologies, including trashing, sorting, spreading and drying to avoid multiplication enable us to minimize portability at all stages for food-security. Multiple value-added drying lines have reduced pre/post-harvest losses permanently; our funded/economic survival sustained us in productivity for economic stability, so we dominated losses. The drying process in food/maize/grits value-added grain is being also irradiated as IAEA/FAO appointed us sole technological-stakeholders in Pakistan since 1995. Economic losses are 30-40% during peak-season in cold days. This loss is being minimized by our mobile-drying services. High moisture content instantly removes safe limits for food-security, applies multiple technologies (mobile-drying, sun-drying, trolley-drying, sheet-drying, roof-drying, open area-drying), then moves to grind, gritting, powdering, crushing, etc. In mobile drying, we apply a drying temperature of 60-70°C approx. for 2-3 hours. Later the temperature is 50-55°C for 2-3 hours which reduces portability and longer food shelf life. In early 1975 we approached EU/USA dryer-manufactures such as SIMON-DRYERS, prices were high. We hired technical NL dryer-consultants; local drying-lines were developed at 20 times less cost. All SDGs has been industrialized. Our 40 years of innovated industrial-based FOOD-SECURITY TECH is ready to save FOOD-SAFETY by 2020-2023, instead of 2050.

Keywords: *Agriculture Technology, Agriculture Productivity, Food Safety, Organized Food System.*

PROSPECTS FOR SUSTAINABLE SOCIO-ECONOMIC DEVELOPMENT OF THE ADMINISTRATIVE REGIONS OF BELARUS

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Abstract

The article considers promising directions of sustainable socio-economic development of administrative regions of Belarus. The objective and main objectives of sustainable development are outlined, priorities for the socio-economic development of the administrative regions of the Republic of Belarus are determined. A cluster assessment of the modern state of development of administrative districts of the Mogilev region has been carried out. Strengths and competitive advantages of development of Belarus regions have been identified. At the same time, the potential opportunities for sustainable socio-economic development of Belarus have been identified and the main directions for improving the agrarian economy of the region have been proposed. The economy of the administrative region is considered as a complex of interacting enterprises and organizations of various types of activities, among which agriculture plays a key role. The main goal of developing promising directions for the sustainable development of administrative regions is aimed at ensuring the integrated balanced sustainable development of regions based on increasing the competitiveness of product production and introducing innovations with the attraction of investment, effective use of resource potential, eliminating territorial imbalances in labor and wages, and improving the quality of life of the population. As a starting point for the development of the main directions of sustainable development of the region, an analysis of the main problems and weaknesses is used. Promising directions of development of social and economic spheres of regions are highlighted. Among other things, the main ways of developing the agriculture of the regions are identified. A system of measures to improve the organization of livestock and crop industries has been proposed. Due to the key role of agricultural activities, the main indicators of their functioning in the near future are identified. A set of new innovative business projects has also been proposed to ensure the long-term sustainable socio-economic development of the administrative regions of Belarus.

Keywords: *assessment, sustainable development, administrative district, system, Belarus.*

PROBLEMS, PROSPECTS AND EXPERIENCE IN THE IMPLEMENTATION OF PRECISION FARMING IN THE REPUBLIC OF BELARUS IN THE CONTEXT OF NATIONAL LAND USE

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Abstract

Belarus has a high potential for introducing precision farming systems in agricultural production. One advantage is the availability of more than 1380 agricultural enterprises, with an average area of agricultural land of 5.3 thousand hectares, and an average area of arable land of 3.5 thousand hectares. Of these agricultural lands 2.55 % are in a private land use, while 97.45 % are state-owned agricultural enterprises. Furthermore, agricultural land can only be owned by the state. Based on the current situation, the development of precision farming systems should focus on large agricultural enterprises, and not private farms. However, there are the widespread introduction of precision farming systems in the country's agricultural industries. Most important is the current system of on-farm land management that is focused on traditional energy and resource-intensive farming. In the framework of this research for the introduction of precision farming, the following results were obtained: 1) The most effective methods for creating task maps for the differential application of mineral fertilizers were identified; 2) a technique for using ultra-high resolution remote sensing data to predict the yield of grain and forage crops was developed. Implementation of these measures when introducing differential fertilizer application allows increasing the profitability by: 2.2 % for winter crops, 1.3 % for sugar beets, 1.1 % for rapeseed for oilseeds and 0.8 % for malting barley.

Keywords: *Agricultural enterprises, Land management, Farming system, Profitability.*

ENTREPRENEURIAL ORIENTATION EFFECTIVENESS AND PERFORMANCE OF YOUNG WOMEN AGRIBUSINESS OWNERS: THE MODERATING EFFECTS OF SOCIAL AND BUSINESS ENVIRONMENTS

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Abstract

The survival probabilities are lower among women-owned agribusinesses. This research examined how key entrepreneurial orientation (EO) dimensions influence performance of young women agribusiness owners, as well as the moderating effects of social and business environments on these relationships. Data were collected from a sample of 365 young women agri-food processing business owners in Benin (West Africa). Moderated multiple regression methods were used to test multiple hypotheses including the interaction effects of social and business environments. The three EO dimensions identified in the context of young women agribusiness owners, namely Innovative EO, Pro-active EO and Risk-taking EO, positively influenced business performance. The joint effect of EO and social environment was not significant on business performance. In contrast, the business environment negatively moderated the relationship between EO and business performance. Furthermore, there was a three-way interaction between EO, social and business environments, such that these young women entrepreneurs achieved low level of performance when adopting EO in social and business environments with high levels of barriers. Policy schemes designed to support young women agribusiness owners are likely to benefit from a greater focus on enhancing innovative, pro-active and risk-taking attitudes. Training can be planned to help potential young women agribusiness owners to acquire the appropriate EO. NGO and professional training institutions could be the leaders in the implementation of these actions. This study draws attention to the specific conditions that empower in particular young women agricultural entrepreneurship in developing contexts. Integrated approaches are needed to successfully promote conditions that empower young women's entrepreneurship.

Keywords: *Innovativeness, pro-activeness, risk-taking, performance, small-medium agribusinesses.*

COORDINATION OF RURAL DEVELOPMENT: AN EXPLORATORY COMPARATIVE STUDY IN BOSNIA, MONTENEGRO AND SERBIA

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Abstract

Coordinated Agriculture and Rural Development (ARD) is one of the preconditions for inclusive economic growth of rural areas of Bosnia, Montenegro and Serbia (BMS) and the integration of these countries into the European Union (EU). This paper analyses and compares the existing state of ARD coordination in BMS and the political and institutional framework that facilitates it. The required information came through an extensive review of the relevant literature and web-based pre-tested questionnaire survey of 155 key officials of public, civil society and international organizations working for the ARD in BMS. Results reveal that coordination of ARD policy design, implementation and evaluation is still in its infancy in BMS and characterize a lack and/or weakness of coordination among the relevant institutions. Besides, the problem is identified during all phases of the policy cycle (i.e. design, implementation, monitoring and evaluation) and both at central as well as local level. Ineffective coordination is in part due to the lack of effective and institutionalized communication and information dissemination mechanisms, lack of a common understanding of ‘rural’ and ‘rural development’ concepts, and inadequacy of human resources. An effective coordination mechanism for ARD would reduce financial and transaction costs.

Keywords: *Rural development, Coordination, Bosnia, Montenegro, Serbia.*

GOVERNANCE OF AGRICULTURAL AND RURAL DEVELOPMENT POLICY CYCLE IN BOSNIA, MONTENEGRO AND SERBIA: A COMPARATIVE ANALYSIS

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Abstract

Agriculture is important for its contribution to Gross Domestic Product (GDP), employment and poverty reduction in rural areas of Bosnia, Montenegro and Serbia (BMS). Agricultural and rural development (ARD) processes should be well governed in order to yield expected outcomes and impacts. Governance comprises mechanisms, institutions and processes for making and implementing decisions. Governance is relevant for rural development both as process and as structure. The paper makes a comparative analysis of problems regarding the governance of ARD policy cycle (i.e. design, implementation, and monitoring and evaluation) in BMS. Research is based on an extended literature review and questionnaire surveys. Questionnaires were answered via email by 73 actors in Bosnia, 35 in Montenegro, and 77 in Serbia. Respondents included representatives of public, civil society and international organizations dealing with ARD issues. Frequencies of problems mentioned by respondents were marked as following: A = High Importance (mentioned by >50% of respondents); B = Moderate Importance (25-50%); C = Low Importance (>25%). Problems regarding each stage of the ARD policy cycle were clustered. The main problem categories regard consultation, communication and participation process; fragmented, unstable and unbalanced policy; knowledge and human capital; policy theory and practice gaps; political context and administrative set up; and social and economic issues. Problems faced by the actors involved in ARD policy cycle change according to the policy cycle phase and actors' categories (public, civil society, international). Nevertheless, they are mainly related to other actors' attitude, agendas and policies and/or to procedures and the legal environment. Improved ARD policy implies optimising complementarities between public, civil society and private stakeholders. A better coordination of ARD can help solving most of the identified governance problems. There is a strong need for mobilization of all rural stakeholders and economic actors through appropriate governance arrangements.

Keywords: *Governance, Rural development, Policy cycle, Bosnia, Montenegro, Serbia.*

IMPACTS OF RAINFALL SPATIAL AND TEMPORAL IRREGULARITIES OVER THE RAINFED AGRICULTURE IN BRAZILIAN SEMI-ARID REGION

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Abstract

This study aimed to evaluate the production of rainfed crops: beans, cassava and corn, between 1950 and 2019 in Ceará State, Brazil. It is assumed that spatial and temporal rainfall irregularities caused instability over the production of these crops. The averages and standard deviations of rainfall, productivity and production value per hectare of these crops were estimated. The study classified rainfall in 3 periods: "Scarcity"; "Excess" and "Normal". The "scarcity" period was observed in 26 years. It includes rainfall below the average, subtracted from half of standard deviation. The "excess" period, observed in 19 years, incorporated those with rainfall over the average rainfall plus half of a standard deviation. The "normal" period, occurred in 25 years, was situated in the middle. The synergy index (INSE) was created. It aggregated, in a weighted, way variables: productivity, production values per hectare of crops and rainfall. It used the principal components decomposition technique, from factor analysis method, to generate the weights of the indicators used in the INSE. The results showed that, in the "scarcity" period, the means of all indicators, were smaller and had the greatest instability. In the "excess" years of rainfall, indicators were also very unstable, but less than in the "scarcity" one. In the "normal" period, averages were higher and more stable than in the others. The main conclusion is: in only 25 of 70 years (35,7%) it was possible to produce rainfed crops in Brazilian semi-arid region in a stable way, giving the actual level of available technologies in this region.

Keywords: *Brazilian Northeast, Family farming, Drought, Adapted Agriculture Technologies, Rural Poverty.*

THE INTEREST OF YOUNG PEOPLE FOR STUDYING AGRICULTURE

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Abstract

The paper explores the interest of young people for studying agriculture at Križevci College of Agriculture in Croatia. Particular focus is placed on students' motivation to study agriculture and the role of extracurricular activities and standard in the quality of studying in general. The survey was conducted over a five-year period from 2013/14 to 2017/18 on a suitable sample of 322 freshmen. The results of the research showed that the College needed better marketing promotion, continuous improvement of the quality of the students' standard and the development of extracurricular activities. However, students had a very positive assessment of the reputation, tradition and historical significance of the College, which greatly influenced the level of students' overall interest in studying. In addition, the professional study of agriculture enables students to acquire professional knowledge and create practical skills and experiences, which increases their chances for instant employment. Through continuous research of students' wishes and needs, the obtained data are implemented in the strategic documents of the College.

Keywords: *interest, students, agricultural studies, Križevci College of Agriculture, survey.*

ANALYSIS OF THE TRENDS ON SEEDS SUPPLY WITH HIGH GENETIC POTENTIAL OF OIL PALM

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Abstract

The international market of palm oil seed depends of a different kind of factors and needs a deployment on a long term view to consider the management of the lifespan of a plantation. The objective is to understand the structure of the market for palm oil seed supply and the correlation between some macro factors and the seed production. The study therefore seeks to determine: the accessible market, market shares, and the various factors influencing the market. In order to study the interactions between sales and other indicators, different prices, indices and tonnages per month have been collected on Index Mundi and PSD. Added to this are the productions and exports of the main producing countries. All the values collected cover the years 1995 to 2018. We will study the interactions of these data series in the following section and look for possible correlations to better target the monitoring of the economic indicators having the greatest impact on the sector. To determine the number of seeds potentially salable, it was necessary to integrate the following data for each year: density, potential reject and replanting rate. The results show a remarkable correlation of the CPO with the price of gold (0.85). It is interesting to study it given the strong correlation coefficient. According to the Bullionvault company, the main factors influencing the price of gold are inflation, oil (coefficient here 0.90) and the US dollar. It may therefore be interesting to follow the movements of these indices to anticipate possible variations in the price of gold and therefore of the CPO. However, we must remain cautious in interpreting the results and put these values in context. It is possible that two strongly correlated values are due to another factor not present in this matrix.

Key words: *Seed supply, palm oil, trends analysis.*

RURAL AGRICULTURE AND POVERTY TRAP: CAN CLIMATE-SMART INNOVATIONS PROVIDE BREAKEVEN SOLUTIONS TO SMALLHOLDER FARMERS?

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Abstract

Agriculture is widely recognized as the solution to food insecurity and poverty, especially in rural areas. Yet, the World Bank (2007) asserts that 75% of the world's poor live in rural areas, and agriculture is the primary source of their livelihood. Given the report, one may wonder if the observed correlation between agriculture and poverty also suggests causation. If that is the case, then what such causal relationship might be? Is agriculture a vehicle for poverty alleviation or a source of poverty trap? In this frame, the role of climate change is rather undisputed: associated extreme weather phenomena cause severe negative impacts on agriculture, exacerbating rural poverty. However, FAO (2018) assures that climate-smart agriculture (CSA) can potentially reverse the situation by eliminating poverty and food insecurity. Against this backdrop, the paper investigates whether smallholder farmers who adopt CSA could achieve food security and better income. This aim was approached through three key research objectives i) to examine the effects of climate change on smallholder farmers, ii) to examine the extent to which smallholder farmers adopt CSA and the barriers to adoption, and iii) to investigate empirically the effects of CSA practices in terms of food security and poverty alleviation. The Upper West and Upper East regions in Ghana were selected purposively for the case study, and the data collected were analyzed using inferential and descriptive techniques. The results revealed no statistically significant relationship between the adoption of CSA with food security and income. Poor socioeconomic and market conditions marred the expected positive effects of CSA, hence the need for the provision of agricultural infrastructures and inputs as well as the creation of market for commodities.

Keywords: *Rural Agriculture, Poverty, Climate-smart Agriculture, Smallholder Farmers, Food Security.*

RELAUNCH AND PROMOTION OF THE COFFEE SECTOR IN THE COMMUNE OF GROS-MORNE IN HAITI

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Abstract

The article focuses on the axis of agricultural development in relation to the difficult and precarious situation in Haiti. The research analyzes project results which took place over a period of 3 years aiming to support 200 beneficiaries - coffee distributors - in localities like Beaumont, Treille and Corail (Acul / Rivière Blanche, respectively 4th and 3rd communal section). On the technical side, project envisages a production of 120,000 seedlings of coffee trees with the planting of 100,000 seedlings and 20,000 other cover seedlings. Other crosscutting activities included 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 allowing beneficiaries to manage their operations well. The budget planned and requested for the smooth running of all activities is \$ 1,171,040.40. 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.

Key words: *coffee, Haiti, agricultural development.*

Acknowledgement: This research is part of project This “Relaunch and enhancement of the coffee sector in the municipality of Gros-Morne” project, also called REVACA – I.

SMALL FAMILY FARMS IN INDONESIA: CHALLENGES AND INVESTMENT FOR FOOD SECURITY

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Abstract

Small family farms have been defined in many ways, from farm-land holder threshold to many other factors such as labor, asset, and resource. They are key for maintaining nutritional diversity with higher land productivity and diversity of production. They contribute to addressing key challenges related to equity, poverty and employment, such as better opportunities for civic and social engagement, more attachment to local culture and landscapes, and higher levels of trust within communities. In Indonesia, the average of small family farms land is 0.6 hectares, which then varies in each island. Half of the country's population is living in rural areas, where family farming is the predominant activity. In practice, they face some challenges, such as lack of appropriate technologies, difficult access to financial resources and market / distribution channels, demographic pressure impact on declining farmland, weak infrastructure, and environmental issues. Another fact is that in Indonesia 1/5 of small family farms live below national poverty line. Therefore, Indonesian government respond to this situation by promoting some investments for small family farms in order to increase food security in rural and food insecure communities. This paper is based on literature review related to small family farms, as well as extended review from field findings through observations and interviews. Qualitative approach has applied in collecting data. This paper aims to explain more about the characteristics, challenges faced by small family farms, and two investments for farmers in Sekayam sub-district, Sanggau district, which is located in the inter-country border area between Indonesia and Malaysia.

Keywords: *Small family farms, food security, Indonesia.*

MAINSTREAMING OF THE SUSTAINABLE DEVELOPMENT GOALS IN THE MEDITERRANEAN: INTEGRATION INTO POLICIES AND STRATEGIES

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Abstract

In the context of the implementation of the 2030 Agenda for Sustainable Development, which encompasses the Sustainable Development Goals (SDGs), mainstreaming means the landing of the Agenda at the national and local levels and its integration into development plans and budgets. This review paper casts light on approaches adopted in the Mediterranean countries to incorporate the SDGs into their national development policies, plans and strategies. It draws upon a comprehensive analysis of the Voluntary National Reviews (VNRs) on the implementation of the SDGs submitted by Mediterranean countries from 2016 to 2019. Mediterranean countries have taken concrete measures to map existing policies against each of the SDG-targets in order to identify policy gaps and to mainstream the 2030 Agenda into their legal and policy frameworks. They used different policy instruments and planning frameworks to take up the 2030 Agenda such as national development plans and strategies (e.g. Albania, Algeria, Croatia, Montenegro, Italy, Slovenia, Turkey), vision documents (e.g. Egypt, Malta, Slovenia, Tunisia) and action plans (e.g. Algeria, France, Spain). A few Mediterranean countries (e.g. Cyprus, Greece, Israel, Lebanon and Morocco) did not adopt any integrated policy instrument and opted for the implementation of the SDGs through existing national policies and strategies. The harmonization of national development plans and strategies with the SDGs is a continuous process and needs to be implemented across sectors. The analysis of the VNRs shows that little attention was dedicated to address trade-offs through policy integration. The achievement of the SDGs implies new modes of policy making as well as a better cross-sectoral coordination and harmonisation of policies in Mediterranean countries. Sharing lessons learned and mutual policy learning among Mediterranean countries could help ensuring a step forward from the formal description of legislation in the VNRs.

Keywords: *SDGs, 2030 Agenda for Sustainable Development, Mediterranean basin, integrated policy, policy mainstreaming, policy coordination.*

IMPACTS OF COVID-19 ON FOOD SECURITY AND FOOD SYSTEM SUSTAINABILITY

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Abstract

The COVID-19 pandemic has taken a heavy toll on the population and economies. It also undermined food security and food system sustainability. In this context, this review paper analyses the outbreak impacts on the different dimensions of food security (viz. availability, access, utilisation, stability) and food system sustainability (viz. environmental, economic, social), and explores possible solutions to mitigate its negative consequences. The pandemic has affected food security both directly, leading to a decrease in food production and availability, and indirectly, as lockdown, social distancing, movement restrictions and other containment measures taken by local and national governments have undermined people's ability, especially the most vulnerable, to access food (cf. food prices) and to have a healthy and diverse diet (cf. food utilisation). The impacts of COVID-19 on the stability dimension of food security will depend on the duration of the emergency. Furthermore, the outbreak had severe consequences on the overall sustainability of the food systems (cf. production, processing, distribution, consumption); disruptions of food systems caused by COVID-19 affect not only the food system functioning but also its performance and sustainability. However, food-related impacts of the pandemic vary not only from a country to another – depending, among others, on the epidemiological situation – but also among socio-economic groups. Indeed, it seems that COVID-19 is particularly affecting developing countries, whose food systems were already under strain, and poor and vulnerable households, which already suffered from food insecurity and malnutrition. Of particular concern are the impacts on children, women and indigenous communities. The COVID-19 pandemic highlighted the unsustainability of the current food systems. Therefore, recovery plans should include actions to foster transition towards a sustainable and resilient food system. Only a sustainable system could withstand severe shocks such as COVID-19 and ensure food security under similar stressful conditions.

Keywords: *COVID-19, coronavirus, food security, sustainable food systems, social vulnerability.*

PASTORALISM IN THE MAGHREB: A REVIEW ON ENVIRONMENTAL, SOCIO-CULTURAL, ECONOMIC AND POLITICAL ASPECTS

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Abstract

Pastoralism is a livelihood system based on extensive production of livestock (e.g. cattle, sheep, goats, camels) mainly on marginal lands. It is a traditional activity in the Mediterranean in general and the Maghreb (viz. Algeria, Morocco, Tunisia) in particular. This review casts light on research regarding pastoralism in the Maghreb. In particular, the paper analyses the benefits of pastoralism as well as the challenges faced by pastoralists in the region from the environmental, socio-cultural, economic and political points of views. A search performed in July 2020 on the Web of Science yielded 113 documents and 68 of them were included in the systematic review. The analysed literature emphasizes the negative impacts of pastoralism and the challenges faced by pastoral communities in the Maghreb. These include climate change, land degradation and desertification, poverty and livelihood vulnerability as well as the ongoing erosion of pastoral culture and traditions. Doing so, scholars question the future of pastoralism in the region and highlight the need for its adaptation and transformation through, among others, moving towards agro-pastoral systems. There is a dearth of articles that highlight the positive impacts and benefits of pastoralism in the Maghreb. However, the literature shows that pastoralism has a long tradition and is an integral part of the Maghrebi culture and history, and values the traditional knowledge of pastoralists as well as their adaptive capacity. The review shows that there is a gap in research on pastoralism in the Maghreb especially regarding economics. In this context, regional projects such as PACTORES (Pastoral ACTORs, Ecosystem services and Society as key elements of agro-pastoral systems in the Mediterranean) result crucial to bridge the current knowledge gap and foster the sustainable development of pastoralism in the Maghreb and the Mediterranean at large.

Keywords: *agro-pastoral systems, sustainability, Mediterranean, Algeria, Tunisia, Morocco.*

EXPERIENTIAL LEARNING AS A LEVER FOR RURAL DEVELOPMENT - CIHEAM BARI CASE STUDY WITHIN “NEXTFOOD” PROJECT

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Abstract

Forms of experiential learning in postgraduate education are considered of key importance for preparing professionals ready to engage with the challenges of sustainable development. This is very true in education and training concerning sustainable farming and agrifood systems. These areas reflect complex realities where different sectors and actors act separately, for individual objectives and frequently in conflict. Traditional discipline-based approaches have shown their limits in providing learners with the necessary competences, including soft skills, to govern such complex realities in a sustainable way. During the AY 2018/19, within the framework of EU H2020 “*NextFood*” project, CIHEAM Bari introduced, in the 1st year of the Mediterranean Organic Agriculture, MSc course, an Action Learning approach, that engaged students in a real local agrifood system with stakeholders and challenges aiming at identifying measures supporting local sustainable development. The final goal of this pilot initiative was to build specific soft skills (observation, reflection, dialogues, participation, visioning) considered important for managing processes in an interdisciplinary and collective way. Students specifically focused on traditional products at risk of extinction in specific territories. They, through literature review, field visits, interviews and discussions with a range of actors, envisioned potential ways for the products valorization, proposing recommendations to the concerned actors. Students found the experience well aligned to their general study programme, successful in putting into use the knowledge acquired through the traditional lectures and developing their skills to work in a transdisciplinary way and to manage multi-actor processes. The applied approach resulted in a valuable experience and solid base that have been permanently integrated in the MSc curricula.

Keywords: *Experiential learning, Soft skills, Competences, Rural development.*

GOVERNANCE IN AGRICULTURAL COOPERATIVES

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Abstract

The global experience in cooperation and its market indicate that cooperatives hold substantial market shares in agriculture industry—about 80 % in the Netherlands and Finland, about 50 % in Italy and France. At the same time in Latvia, as in other post-communist countries, the development of cooperatives in the agricultural sector is rather low. The aim of the current paper is to determine governance among agricultural cooperatives. In particular, it aims to (1) explain the importance of governance based on scientific research and definitions; (2) identify what governance models are offered by the Latvian Law on Cooperative Societies; and (3) establish what are the governance groups and the key factors of their interrelationships. Legislation analysis indicates that the Latvian Law on Cooperative Societies is based on the German law. Likewise, it is also progressive and promotes cooperation in all respects. However, the legal component is not the determining factor for a successful development of agricultural cooperatives. If market conditions are equal at the macroeconomic level, especially in the Member States of the European Union, then the strength of the cooperatives is to be found at the microeconomic level. According to scientists and business experts, a strong internal environment makes company more competitive and risk-resistant. As the governance models of Latvian cooperatives do not differ from the governance models of cooperatives in the other countries, the links between these groups (members, board of members, management, etc.), such as trust, interdependencies, legitimacy, transparency, are highly important.

Key words: *governance, agricultural cooperatives.*

GASTRONOMIC TOURISM FOR SUSTAINABLE DEVELOPMENT OF RURAL AREAS OF LATVIA

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Abstract

Sustainable development strategy of Latvia states that rural areas of Latvia are experiencing socio-economic depletion, therefore important long-term challenges have been identified. They are related to the creation of quality living and working spaces in rural areas, preservation of cultural heritage, diversification of economic development. By developing gastronomic tourism in rural areas, the socio-economic growth of rural areas can be promoted. Tourism offers that include gastronomic services are popular and in demand among both local and foreign tourists. Unfortunately, some gastronomic tourism service providers in rural areas of Latvia lack knowledge and information on how to create and successfully manage sustainable gastronomic tourism services. The aim of this research is to identify how gastronomic tourism can be used for sustainable development of rural areas of Latvia. Tasks to achieve the aim is to (1) to evaluate gastronomic tourism as one of the instruments of sustainable development in rural areas, (2) to determinate involved parties in development in rural areas, (3) to identify activities, that can be used for the sustainable development of rural areas. Following research methods are used: monographic, analysis, synthesis, data grouping. The research concluded that local gastronomy can be used for sustainable development of rural areas. Gastronomic tourism can be developed via efficient use of rural resources, formation of cooperation clusters, and by diversification, combination and re-profiling of rural farming services. Cooperation between involved parties is an important aspect for sustainable development of rural areas.

Keywords: *gastronomic tourism, sustainable development, rural development.*

EXPLOITATION CHARACTERISTICS ON A LINE OF MACHINES FOR COLLECTING ONIONS

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Abstract

In the last few years, onions have occupied an important place in agricultural production in the Republic of North Macedonia. From year to year, the areas with this crop have been increasing, the production technology is being improved, but a new technique is being introduced, ie a new production line is being implemented, both for sowing and harvesting. Lack of labor is also a major problem in the production of agricultural crops that require a large number of labor, workers, therefore increasing the need to invest in the procurement of modern machinery in order to reduce work processes and reduce costs per hectarearea, in order to obtain a competitive product on the domestic and European market. This scientific paper will show the results obtained from the examination of the exploitation and economic parameters, in order to see the share of the costs of agricultural machinery in onion production, as well as the share of costs in the production or sales price of the product.

Keywords: *Agricultural technique, combine harvester, onion, exploitation.*

SMALLHOLDER FARMERS' RESOURCE ALLOCATION DECISIONS IN A MAIZE-FARMING SYSTEM UNDER CLIMATE RISKS IN MALAWI

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Abstract

The study was conducted to assess smallholder farmer's resource allocation decisions in a maize-farming system under climate risks in Lilongwe, Kasungu, Zomba, Chiradzulu, Thyolo and Machinga districts of Malawi. More specifically, to identify factors that influence the choice of climate variability adaptation strategies by smallholder farmers, to evaluate the ability of DSSAT to predict and collate DTM and non-DTM yields under climatic risk and to use a bio-economic procedure developed using DSSAT and Target-MOTAD and to explore the impact of climatic risk on allocation of resources to DTM and non-DTM production in the sampled regions. Using 2012 and 2015 household panel of 346 households from the stated six districts, along with crop phenology, agronomic management and climatic data from Chitedze Research Station, the Target-MOTAD and DSSAT-CSM models examined smallholder farmers' behaviour under climate risk in Malawi. The paper argues that higher average yields observed from DTM varieties make it the most optimal maize production plan, in maximizing household incomes, food security, and minimizing deviations from the mean while meeting the set target incomes of farmers compared to non-DTM varieties. The multidisciplinary nature of this paper has contributed to the body of research by providing a powerful analytical procedure of modelling farmers' resource allocation decisions in maize based farming systems in Malawi. This study necessitates the use of a combination of biophysical and economic procedures when evaluating promising lines prior to variety release in order to identify the high yielding variety that will continuously bring sustained profits to the farmers amidst climate change.

Key words: *Climate risks, Target MOTAD, DSSAT, smallholder farmers, resource allocation.*

EDUCATIONAL EXTENSIONISM TO PROMOTING RURAL DEVELOPMENT IN MEXICO

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Abstract

Orange production presented low average annual yields in Mexico in the last 10 years (2007 to 2016) 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. 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. In relation to income, there was also an increase of 31.3% for 2014, in relation to the 2012 survey, which was statistically different. For 2016, there was an increase in income of 454%. This was 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. The fruit had better quality and in general, the level of adoption of innovations was maintained between 2014 and 2016. No statistical differences were found.

Keywords: *Education, Incomes, citrus, andragogic.*

AN APPRAISAL OF RURAL YOUTH IN LOCAL HANDICRAFT ACTIVITIES IN SOUTH WESTERN NIGERIA

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Abstract

The study was conducted in south western Nigeria to appraise Youth in entrepreneurial activities meant to enhance employment generation and sustainable rural livelihoods. A multistage sampling procedure was used to select 150 respondents from the six states in the southwestern region. Primary data were collected through the administration of well-structured interview schedule. While the data were summarized using descriptive statistics (such as frequency, percentages, etc.), inferential statistic (i.e. Pearson Product Moment Correlation) was used to make deductions. Results revealed that rural youth in the study area engaged in seven local handicraft activities. These included black smiting, cloth weaving, hair plaiting, basket weaving, woodcarving, pottery, and tie and dye. Majority (68.0%) of the respondents had primary school leaving certificate and Senior Secondary School Certificate. More than half (52.0%) of the youths were from low-income earner families. The need to earn a living (i.e. income generation) was a major driver for youth to learn local handicrafts. Harmonizing available time between schooling and workshop was a major challenge for successful youth engagement in local handicrafts. There was a significant correlation between age and learning of local handicrafts ($r=.233$, $p < 0.05$). The study concluded that youth engages in local handicraft because the activities are money-generating in nature. The study therefore recommends that Government should invest more in rural enterprises in order to increase the purchasing power of households. Also to provide finance for investment so as to increase the rural income level and thereby improving their standard of living.

Keywords: *local handicrafts, sustainable livelihood, entrepreneurial skills.*

MATERIAL PREREQUISITES FOR HUMAN WELLBEING: EMPIRICAL INSIGHTS FROM SPICES FORAGER-FARMERS IN THE RAINFOREST ZONE OF NIGERIA

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Abstract

Spices are horticultural crops used as food adjuncts for enhancing organoleptic properties in food and beverage. They are still largely gathered from the wild despite having potentials of contributing to household wellbeing. As parts of efforts to promote latent potentials entailed in spices enterprise, the study assessed material living conditions of spices forager-farmers in the rainforest zone of Nigeria where spices were gathered from the wild and deliberately cultivated. Imo state was purposively selected for its abundance of spices. Thirty percent of households that gathered spices from the wild and produced them as field crops were randomly selected to give 78 respondents. Socio-economic characteristics of respondents, spices enterprise characteristics, benefits derived, material living conditions and level of material well being of respondents were ascertained. Descriptive and inferential statistics were used to analyze data collected with structured questionnaires. African Black Pepper and Ethiopian pepper were gathered by majority of respondents 92.4% and 88.3%, respectively, while Chilli pepper was predominantly cultivated. Benefits derived from the enterprise included income generation ($\bar{x}= 2.30$) and revival of indigenous knowledge ($\bar{x}= 1.92$). Only 8.8% were always satisfied with the earnings, 12.5% considered the earnings as always sufficient for household expenses. Only 21.2% resided in bedroom flat and only 24.8% had bedroom to themselves, while only 30.0 % had water system of toilet facility. There was no significant relationship between benefits derived and material wellbeing ($r=-0.22$, $p>0.05$). The study concluded that the benefits inherent in spices enterprise should be promoted as capabilities to enhance material wellbeing of rural households.

Keywords: *Spices, NUCs, Material wellbeing, Capabilities, Producer-gatherers, Nigeria.*

EXPLORATIVE ANALYSIS OF BENEFITS DERIVED FROM SPICES PRODUCTION ENTERPRISE IN KANO STATE, NIGERIA

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Abstract

Spices production is not a popular enterprise in Nigeria as majority of spices are still collected from the wild. The study ascertained benefits derived from spices production among farmers who deliberately cultivated spices in Kano state. Multistage sampling technique was used to randomly select two (2) communities each from four (4) Local Government Areas noted for spices production. Twenty percent of producers were randomly selected to give 123 respondents. The study ascertained socio-economic characteristics of respondents, access to information, knowledge of spices production, constraints associated and benefits derived from spices production. Descriptive and inferential statistics were used to analyze data collected with structured questionnaires. Results showed that majority (95.2%) of farmers had no formal education, majority (41.1 %) had large household size of between 6 and 15 persons, majority (82.2 %) produced spices on small holdings with a mean of about 3.75 hectares and mostly cultivated exotic spices were onion (100%) and garlic (95.4%). Access to information on spices was mainly through parents and relatives (\bar{x} = 1.42) and friends (\bar{x} = 1.17). Majority (53.5%) of respondents had high knowledge of spices production. High transportation costs (\bar{x} = 1.46) and cost of inputs (\bar{x} = 1.42) hindered optimum production of spices. Meeting family needs (\bar{x} = 2.64) and multiple yearly harvests (\bar{x} = 2.60) were major benefits derived. There was a significant relationship between knowledge of spices and benefits derived from the production of spices ($r = 0.21$, $p < 0.05$). Extension agents should promote the potentials of these neglected and under-utilized high-value crops among farmers to encourage large scale production.

Keywords: *NUCs, Exotic spices, Advocacy, High-value crops, Nigeria.*

FUNCTIONING OF CLUSTERS IN THE AGRI-FOOD INDUSTRY – THE CASE OF "LESZCZYŃSKIE SMAKI" (LESZCZYŃSKIE FLAVOURS)

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Abstract

A cluster should be treated as a certain spatial and sectoral concentration of entities acting for the benefit of development, performing economic activity on the territory of one or several neighboring regions. Its essence is to stimulate cooperation, speed up innovation processes, and thus improve the competitive position of enterprises operating in it. The aim of the article is to assess to what extent the operation of the food cluster Leszczyńskie Smaki corresponds to the assumptions adopted for this type of initiatives. In particular, it is to answer the question whether the activities undertaken within its framework are conducive to mutual development of partners and the region of which they are an integral part. The Leszczyńskie Samki Cluster was established on the initiative of the City of Leszno and the Leszczyńskie Business Centre. It brings together local food producers, supporting institutions and local authorities. The aim of its establishment was to create a cooperation network which is to generate measurable benefits for its participants by using the strengths of the region – high potential of agriculture and an excellent base of raw materials. The conducted research indicates that the discussed pattern of cooperation in the form of a cluster allows for the implementation of innovative undertakings, including in particular integrating the food industry of the Leszno subregion, science, business environment institutions, local authorities and establishing cooperation with foreign partners. In particular, the role of academic units is significant. It is the main link in the implementation and improvement of competences and technological solutions. Moreover, it serves to exchange information and knowledge through the organization of joint conferences, seminars, workshops and advisory services. The cluster initiative strengthens the position of enterprises and integrates them into the broadly understood agribusiness.

Keywords: *cluster, innovations, agri-food industry.*

COOPERATION OF AGRI-FOOD CLUSTERS WITH UNIVERSITIES: THE CASE STUDY FOR POLAND

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Abstract

Clusters are geographic concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries, and associated institutions (for example universities, standard agencies, trade associations) in particular fields that compete but also cooperate. Poland is positioned to be a major supplier of food for Western Europe. It ranks 4th in the EU in arable land. Agri-food industry clusters are developing dynamically in Poland, which is mainly related to the agri-food specialisation of most regions of the country. Clusters play a significant role in creating supply chains, joint investments and developing innovative solutions in the area of food production and products. For these reasons their development often depends on cooperative relations with scientific institutions, which very often become initiators of joint activities. The aim of this paper is to investigate cooperative relations that arise in agri-food clusters. The article analyses an example of agri-food cluster from the Great Poland region, which mainly develops modern distribution channels of agri-food products produced by its participants. In order to obtain required data an in-depth interview has been conducted with the cluster management. As a result of the analysis it was identified that the cooperation between cluster participants and the research institution is mainly based on creating interpersonal relations by direct and personal interactions between cluster entrepreneurs and university research staff. The results of the study indicate that the increase in cluster initiatives in the agri-food industry requires the creation of cluster initiative centres at agricultural universities, whose main objective would be to promote and establish personal contacts between scientists and entrepreneurs.

Keywords: *Cluster, Interconnectedness, Agri-food industry.*

COMMUNITY-SUPPORTED AGRICULTURE IN TIMES OF PANDEMICS

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Abstract

The 2019-2020 coronavirus pandemic is not just about the spread of a disease and the efforts to quarantine it: it is also about the largest global recession in modern history given that about 33% of the global population is placed on lockdown. The pandemic has economic (betting, entertainment, events, financial markets, gambling, HoReCa, manufacturing, publishing, retail, science, technology, tourism, and transportation), educational, political (civil rights, democracy, and sovereignty), religious, and social impacts. Agriculture all over the world is experiencing the negative effects of the pandemic: dairy industry, fishing industry, meat industry, and wine industry are just a few examples. Among economic impact, the retail sector has seen product demand exceeding supply, which resulted in empty retail shelves. Some retailers appealed to contactless home delivery, and an increasing number of small-scale farmers sell their produce directly using digital technologies, turning community-supported agriculture and direct-sale delivery systems into rising ones. This system can make both producers and consumers benefit providing that they observe some (if not all) of ten founding principles of the Teikei System: acceptance of produce, deepening of friendship, democratic management, intended production, learning among each group, maintenance of the appropriate group scale, mutual assistance, mutual concession in the price setting decision, self-distribution, and steady development. This article focuses on the best Teikei System principles to apply during and after the 2019-2020 coronavirus pandemics for the small farmers to survive.

Keywords: *community-supported agriculture, agricultural retail, Teikei System, 2019-2020 coronavirus pandemics impact on agriculture.*

INTELLIGENT SYSTEM FOR IDENTIFYING AND SORTING FRUITS AND VEGETABLES BY COLOR

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Abstract

Currently, sorting fruits and vegetables in the food industry is a tedious, largely physical process. Process automation leads to increased efficiency and can be improved in several ways. In this paper a simple robotic arm is used to sort different objects in shape and size using a predefined color identification algorithm. The main objective of this research is to analyze how a robot equipped with a color sensor can identify products, capture them and then sort them according to their color by quality categories. To accomplish this, we used a Raspberry Pi minicomputer (with a Raspbian OS operating system), a TCS34725 RGB color sensor, and a robotic arm powered by four DC servomotors. The robot's programming was made in the Python language, available for free, which allowed the development of efficient applications that could be further improved. The robot arm was controlled by modulating PWM signals with an integrated circuit type PCA9685 that operates with a programmable frequency up to 1526 Hz with an adjustable duty cycle. Applying such a simple system, made at low cost, in production units in the food industry to scan and identify defects of fruits and vegetables or in areas of fruit and vegetable cultivation (rural areas) where the installation of expensive sorters is very difficult brings many user benefits.

Keywords: *Color identification, Raspberry Pi, robot arm, Python.*

A PACKAGE OF MATPLOTLIB TEMPLATES FOR AGRI-FOOD DATA REPRESENTATION

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Abstract

Like any other scientific field, agricultural research relies on actual and experimental data, statistics, and general data processing. In this respect, Python is currently the most popular programming language among scientists due to its advantages: it is free, widespread, runs on almost all operating systems, it has custom libraries/tools that focus on specific research aspects. Most often, food science researchers make use of data visualization to analyze data, highlight important factors, or lay out the general data trend. Matplotlib is the most popular open-source Python data visualization tool offering extensive means to create attractive scientific plots, able to generate highly customizable, publication quality charts. However, due to its abundant programming options, for users at the beginning of their Matplotlib journey this situation discourages and, in certain circumstances, creates confusion. This paper aims to bring to the agricultural scientific community a clearer view on how to use Matplotlib to produce useful attractive plots. Moreover, the authors offer three sets of Matplotlib scripts: (1) a group of 15 fully customizable templates (one script for each of the most usual plots); each script is divided into distinct sections to make it easier to follow; comments with details such as role, parameter values, useful links/advice are provided for each line of code; (2) a set of 15 short scripts that produce simple plots with a Matplotlib default aspect, (can be used when the user is primarily interested in making input datatests); (3) a set of nine general purpose scripts used to control the plotting area. Real-world examples from agricultural engineering and biology are provided to demonstrate the described plotting approach.

Keywords: *agricultural research, data visualization, template scripts, Matplotlib.*

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.*

MANURES INFLUENCES ON GROWTH AND FRUITS QUALITY OF OLIVE TREES IN AL JOUF REGION, SAUDI ARABIA KINGDOM

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Abstract

Effect of camel manure on growth and fruit quality of 15 years old Nepal olive tree was evaluated and compared with sheep and chicken manures as natural fertilizers. Landscape for this research was divided into 14 squares with planting density of 20 trees in each square; under regular drip irrigation system and without any added chemical fertilizers or pesticides. According to the obtained results, the shoot growth rate (cm), fruit yield, fruit physical characteristics - length (cm), diameter (cm), weight (g), volume (cm³), flesh weight (g) - and oil percentages were significantly increased affected by camel manure utilization compared to sheep and chicken manures and the control without any treatment. The amount of manure produced by animals is very variable, even within species, partly due to differences in dry matter content of the manure. As water is not a very interesting component, we will be dealing mainly with the dry matter, the organic matter and the nutrients N and P. Organic fertilizers (special formula) have great nutritional requirements for olive tree to improve olive tree growth properties and oil ratios. Camel manure is one of the best options to increase the properties of olive trees (rapid growth of branches, increase in olive yield and the proportion of olive oil). To complete this research study (PhD thesis), the comparison between different camel droppings necessarily requires studying the diversity of nutrients, their stability and their impact on the growth and production of olive trees.

Keywords: *Manures, Olive, Al-Jouf region, Saudi Arabia.*

AGRI-ENVIRONMENTAL INDICATORS AS A TOOL FOR CLASSIFYING EUROPEAN UNION MEMBER COUNTRIES

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Abstract

Agriculture plays a significant role in the field of sustainable development. For this reason, it is clear why recent research in the field of sustainability is related to the topic of sustainable agriculture. There are many definitions of sustainable agriculture in the literature, but they are all based on three basic principles: ecological stability, economic sustainability and social acceptability. In general, global sustainability and even global sustainability in agriculture, cannot be achieved until all the actors become aware of their significant role in such a vital project. Therefore, it is necessary to constantly monitor the achievements of the goals of sustainable agriculture. Many institutions offer different sets of indicators to observe the achievement of the given goals of sustainable agriculture. Most of them offer a set of indicators to analyze only the ecological aspect of sustainable agriculture. In this study, the authors opted for a set of agri-environmental indicators provided by Eurostat which offers 12 headline indicators and 62 sub-indicators that further explain headline indicators. Given that the data for individual indicators are incomplete, this study included 8 headline indicators and the corresponding 12 sub-indicators. Based on a set of 12 selected indicators, a cluster analysis was conducted for the European Union (EU) member countries for 2016. The results of analysis indicated that observed countries were grouped into 6 homogeneous clusters. After grouping countries, additional analysis of indicators by cluster was undertaken, attempting to identify agri-environmental areas where countries of the same group are lagging behind.

Keywords: *agri-environmental indicators, cluster analysis, European Union, sustainable agriculture.*

GLOBAL TRENDS, CHALLENGES AND PERSPECTIVES IN INTERNATIONAL TRADE IN AGRICULTURAL AND FOOD PRODUCTS

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Abstract

In the last few decades, significant changes have taken place in world trade in agricultural products. The volume of global trade has increased several times, and its growth was faster than the growth of world agricultural production. Transnational companies with global production and distribution systems have taken over trade structures as a key paradigm for the organization of world agricultural trade. Changes in demand have spurred the emergence of global markets and increased the importance of trade. Certain projections suggest that the role of trade in meeting global food demand will further increase in the coming period. However, with the advent of the global COVID-19 pandemic, world trade in agri-food products is likely to have negative implications for the entire food supply chain. Lifestyle changes and measures to reduce the spread of COVID-19 have significantly changed economic activity, employment, food consumption and the work environment. In addition to significant health effects, there are also broad macroeconomic impacts that specifically affect the agri-food sector. It is important to consider the extent to which a pandemic crisis can affect agricultural production, and thus security of food supply and trade. A globally interconnected agribusiness system and trade is crucial for food supply. In the coming period, the stability of trade relations in the trade of agricultural products will be crucial for preserving the food security of the population and sustainable agricultural production.

Keywords: *trends, challenges, agricultural production, food supply.*

DYNAMICS OF CHANGE IN THE WORLD FOOD CONSUMPTION SYSTEM - TRENDS AND CHALLENGES

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Abstract

In today's conditions, the issue of development of agricultural production and food security is a strong challenge on a global scale. The realization of the nutrition of the world's population cannot be achieved without functional, sustainable production systems that provide a sufficient amount of quality, affordable and healthy food. In times of intensive global economic exchange, it is possible to provide the necessary quantities of food in a relatively quick and easy way depending on the available financial and other resources available to states and its population. However, national food self-sufficiency is not a sufficient guarantee to provide food on a personal level. Food security in recent decades has mainly focused on production and the challenges facing agricultural systems. With urbanization, revenue growth, consolidation, and globalization of the food industry, the length of food supply chains has increased and the food environment has become more complex. Dynamic changes in food supply chains are underway, which are characterized by the modernization of food marketing, the development of agribusiness and the establishment of sustainable food standards and regulations.

Keywords: *food, sustainability, security, self-sufficiency, agriculture.*

EXPORT OF AGRICULTURAL PRODUCTS AS AN INDICATOR OF PERFORMANCE OF RURAL BASE SMALL SCALE AGRI-BUSINESSES, SOUTH AFRICA

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Abstract

The performance of Small-scale agricultural businesses (SSABs) is vital as they generate employment and income for poor rural communities. This paper examines export as a pillar of globalisation, which was used as an indicator to access performance by rural based small-scale agri-businesses (SSABs) in South Africa. Since the democratic transition in 1994, SSABs have been exposed to the forces of globalisation and to various international forces, which have been presumed to result in poor performances and closure of some of these businesses across rural parts of South Africa. The paper addresses a basic question in the small business/globalisation literature: What is the impact of globalisation on small firm performance? Arguing from the new growth theory, this paper investigate exportation opportunities (exogenous factor for growth) that result from trade liberalisation (as a component of globalisation) and its impact thereof on the SSABs in a rural region of South Africa. Business success was measured by owner's perception of growth in employment and gross profit. The results lead to the conclusion that higher levels of exporting contributes to improved economic performance.

Key words: *Exogenous, endogenous, growth, globalisation, small-scale agri-businesses, exporting, South Africa.*

CONSUMER DEMAND FOR BRANDED AND PACKAGED PROCESSED FOODS: COMPARISON OF SELECTED RURAL AND URBAN AREAS IN TANZANIA

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Abstract

Producers' understanding of the habitual heterogeneity of the consumers is an essential marketing strategy to win the potential market of processed food. In Tanzania, studies on consumer's preferences, consumer's awareness and the importance of packaging and branding of the processed foods have been conducted only in urban areas. This makes the problem partially assessed to the extent of neither covering the rural consumers as well nor determining if at all there is any comparison difference between the two sets of consumers. This study intended to explore the demand for packaged and branded processed food products in selected urban and rural towns of Tanzania. Sample size of 630 respondents was randomly selected and interviewed in 2017. Results showed that there were variations and some similarities in consumers' habits in rural and urban areas, in small and big towns on; nature of processed food bought, buying places and the most influencing drivers for the preferred product. Basing of the Garrett's ranking technique. The study further revealed that a majority of the consumers in urban areas were being driven by "quantity" while the rural consumers were being influenced by "storage". While "large volume" was the most important factor influencing urban consumers at the purchase of packaged edible oil, "safety" was the most important attribute when rural consumers. In addition, the study showed that consumers, both in rural towns and urban cities preferred branded to unbranded products due to their preference for "good sensory test". The difference between rural and urban consumers' behaviors at the purchase of packaged and branded processed foods was significant ($p < 0.05$). For the agribusiness firms to capture larger markets of their products there is a need for them to understand the consumers' behaviors and incorporate standard branding and packaging attributes into their marketing strategies.

Key words: *Packaging, Branding, Processed foods, Tanzania.*

INTEGRATED NUTRIENT MANAGEMENT OF *KHARIF* SORGHUM (*SORGHUM BICOLOR* L. MOENCH) AND *RABI* CHICKPEA (*CICER ARIETINUM* L.) AS A LOW COST PRODUCTION CROPPING SYSTEM

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Abstract

The present study was conducted under field condition during 2012 and 2013 with kharif sorghum and rabi chickpea cropping system at ARI Main Farm, Rajendranagar, Hyderabad, India. The experiment was laid out in split plot design with three main treatments and three sub-treatments, replicated thrice. There are 9 treatments which included application of three different organic manures as a main treatments viz., Farm Yard Manure (FYM), Vermicompost (VC) and Neem Seed Cake (NSC) and their combinations with 0%, 50% and 100% RDF as sub plot treatments. Manures were applied at recommended doses (5 t ha⁻¹ for FYM and 2.5 t ha⁻¹ for VC and NSC). The data recorded for two years and two seasons (kharif and rabi) to evaluate the economics of the integrated nutrient management as low cost production cropping system. Among the different integrated nutrient management the highest net returns and cost benefit ratio during both years 2012 and 2013 of experiments were registered by VC+100 % RDF ₹ 92270, 101161 net returns and 2.68, 2.39 cost benefit ratio, FYM +100 % RDF reported the second net returns and cost benefit ratio after VC+100 % RDF, which are ₹ 64257, 89126 net returns, 1.41 and 1.94 cost benefit ratio. The results also showed that VC + 50 % RDF recorded the third role among the integrated nutrient management treatments 81280, 88740 net returns, 2.43, 2.14 as cost benefit ratio frequently, while NSC either sole or integrated with RDF resulted in the least net returns and cost benefit ratios.

Keywords: *B:C ratio, kharif sorghum rabi chickpea cropping system, Rajendranagar*

PARTICIPATION OF WOMEN IN COMBINED AGRICULTURAL AND APIARY ENTERPRISES IN BOSNIA AND HERZEGOVINA: AN EXPLORATORY SURVEY

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Abstract

Apiary science in Bosnia and Herzegovina (BiH) includes a nexus of research impacts: sustainable beekeeping, pollinator-plant interactions, as well as theory for community development that relates to women. BiH has maintained a commitment to local, low-tech solutions to food scarcity. Whereas, large-scale technologically and chemically enhanced agricultural practices have contributed to new diseases and mass morbidity in beekeeping in developed countries, BiH has not enjoyed complete economic and industrial reconstruction following the Bosnian war of 1992-1995, and has thus avoided jeopardizing essential native pollinator species. Increasingly, small-scale, sustainable operations are relied upon to keep native populations intact and avoid bee extinctions. Sustainable beekeeping practices, and women's enterprises, have been studied through case studies in BiH including those of agro-tourism. Agro-cultural-touristic operations foster new connections across generational lines, working with women, young children, and elder members of communities, while enhancing sustainable economic development. Economic gains rely on burgeoning ecological tourism and agro-tourism. Fostering awareness in local communities through public programs generates enthusiasm and environmental preservation while providing livelihoods for female beekeepers and their families. Small-scale interventions lead to scale-ups and sustainable economic development in this region. Agro- food products, including those resulting from good beekeeping practices, enhance the preservation of eco-touristic environments, and all agriculture relies on pollinator-plant interactions of both managed and feral bees. Long-term economic sustainability of rural enterprises, including those of tourism and food security, is increasingly important to women. This paper surveys female communities in economically and environmentally sustainable agro or touristic enterprises, through apiary operations.

Keywords: *Apiary science, Agro-tourism, Female Entrepreneurship, Bosnia and Herzegovina.*

CLUSTERS TO FOSTER MULTIACTOR APPROACHES FOR THE DEVELOPMENT OF AUSTRIAN AGRICULTURE AND RURAL SPACES

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Abstract

In the course of the ERASMUS+ project “Enhancing capacity of universities to initiate and to participate in clusters development on innovation and sustainability principles” (UniClaD) agrarian institutions of several EU countries, Ukraine, Azerbaijan and Moldova, cooperate to foster the cluster development. Partners are agricultural and rural development higher education institutes, research organisations, NGOs and farm enterprises. The first step is to get clear and to collect information about the current clusters’ situation in the partner countries. In Austria various clusters are established, varying in topics, number and structure of participants, type of organisation and management and spatial dimension. Promising to use as good practice examples which will be presented at the conference are: (i) Food Clusters of Upper and Lower Austria - network for the entire supply chain in the food industry; (ii) Machinery Ring - organising and fostering bottom up farm cooperation; (iii) Technopol Wieselburg - international centre for bioenergy, agrarian and food technology, water management; (iv) Austrian Agricultural Cluster - strategic planning, project development, implementation, know how transfer; (v) Network of Culinary - strategic coordination platform among culinary initiatives; (vi) Green Care Austria – cooperation for the provision of social services in rural regions; (vii) Nature Education - network for the qualitative development of nature guides. The first four clusters cover traditional topics and are well established with a significant number of participants. The last three ones deal with innovative topics and are just in their first years of development.

Keywords: *Agrarian Cluster, Rural Development, Cooperation, Pedagogy, Austria.*

COMMUNICATION, DISSEMINATION, AND THE USE OF SOCIAL MEDIA IN H2020 THEMATIC NETWORKS

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Abstract

In order to face new agricultural and forestry challenges, the European Agricultural Knowledge and Innovation System (AKIS) is gaining considerable attention in the European Innovation Partnership for Agricultural Productivity and Sustainability (EIP-AGRI) and hence the European Common Agricultural Policy framework. AKIS aims to bring together various actors, bridging the gap between research and practice to accelerate innovation. Fostering innovation was promoted by the European Union through the development of Thematic Networks (TNs) that aim to collect and share best practices and research results with farmers and foresters in order to exchange new knowledge and innovation for practical uptake. Two important components of fostering innovation in TNs are communication, which aims to promote the project content, and dissemination, which discloses the results. This paper presents commonly used modes of communication and dissemination (C&D) based on an analysis of 28 state-of-the-art TNs within the EURAKNOS H2020 project. The analysis was performed after a desk-top study (investigation of TNs websites), as well as online and face-to-face interviews. Although all TNs applied C&D activities, some TNs do not clearly distinguish communication from dissemination. The results also suggest that, in general, social media enables a good engagement with the end-users, although not all end-user groups are effectively targeted. The observations made in this paper can be used by future TNs to perform efficient and impactful C&D activities. In turn, this may lead to increased exploitation of project outcomes, and thereby accelerate agricultural and forestry innovation and contribute to rural development.

Keywords: *Agriculture, Forestry, Innovation, Result uptake, AKIS, EURAKNOS.*

DAIRY PRODUCTION IN WALLONIA: PROBLEMS AND PERSPECTIVES

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Abstract

Milk and on-farm dairy products represent an important share of the final value of agricultural production in Wallonia. This sector was largely transformed after the adoption of the Common Agricultural Policy, the implementation of milk quotas in 1984 and their suppression in 2015. Based on official statistical data, on a literature review about the possible futures of the Walloon dairy sector, on an exploratory workshop with regional stakeholders and on an on-line survey among representatives of the dairy sector, the research aims to identify the problems of the dairy sector and the possible solutions for the future. Being successful during several decades, the sector encountered more difficulties later on. Environmental problems appeared and the number of dairy farmers and of dairy cows sharply declined, the prices – and so the income – became unstable, especially after the liberalization of the CAP. The capacities of the dairy industry significantly increased and were oriented to the world market, while the consumption patterns largely changed. In order to overcome its difficulties, the dairy sector will have to meet new challenges: emerging consumption patterns, like vegetarianism, human health concerns, new societal expectations about the environment, animal welfare, climate change, biodiversity, landscape preservation, cultural heritage, the numeric revolution and precision agriculture...In the future, the Walloon dairy production will have to be based more significantly on grassland and less on concentrates and imported feedstuffs, with diversified cattle races, larger quantities of milk processed and sold on-farm, more quality-specific (including organic) products, and the organization of production and marketing cooperatives.

Keywords: *Dairy production, Challenges, Perspectives, Wallonia.*

FACTORS DETERMINING ACCESS TO CREDIT BY ORANGE FARMS OWNERS IN TUYENQUANG PROVINCE, VIETNAM

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Abstract

While Vietnam started as a poor agricultural country, her economy has improved in recent years. Economic development has changed the country significantly in all aspects, especially agriculture, rural areas and peasant living standards. Orange and farming models have been encouraged in many localities in Vietnam for a higher income and living standards of the farmers who account for a large proportion of Vietnamese labor structure. Access to credit is one of the essential keys to decrease poverty, promote production, and smoothly increase consumption. However, access to credit by the farm owners has currently got constraints. This paper was identified factors determining access to credit by orange farm's owners in TuyenQuang Province, Vietnam. The study randomly chose 107 farm owners in the study site to interview. The primary data were collected from April to June 2019 by using a structured questionnaire. The Probit model regression was applied to identify the factors. The independent variables were age of farm owners, education level, family size, family labor, farming experience, farm size, social capital, and farm income. The results indicated that the age of farm owners, education level, family size, orange cultivation experience, farm size, and social capital had significant influence on the access to credit of farm owners. Cooperative and intensive extension systems are two recommendations for local authorities and plan makers to improve orange farm owners' access to credit.

Keywords: *Access to credit, Social capital, Orange production, Probit model, Vietnam.*

HOW DO ADAPTATION OPTIONS TO CLIMATE CHANGE, RISK PREFERENCES AND SOCIAL CAPITAL AFFECT TECHNICAL EFFICIENCY OF SMALL VINEYARD FARMERS IN CENTRAL CHILE?

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Abstract

Climate change can be seen as a shock that decreases the value of economic activities and production functions. Therefore, this study estimates technical efficiency as an integrated approach with risk preferences and social capital for small vineyard farmers who have adapted to climate change, because empirical evidence shows the key role of adaptation, risk preferences and social capital related to technical efficiency on a one-to-one basis, but not as overarching analysis. This study took place in the O'Higgins and Maule regions of central Chile, data were collected through a field experiment and an exit survey from September to December 2016. Specifically, we conducted an artefactual field experiment to elicit risk preferences from 175 small vineyard farmers; we used the midpoint method to estimate the Cumulative Prospect Theory (CPT) parameters, which indicate vineyard farmers are risk averse, sensitive to losses, and tend to distort probabilities. Then we applied a stochastic frontier analysis on the main variety area of vineyards. Results showed that the influence of capital (0.55) and number of vines (0.32) is higher enough; whereas, labor (0.13) and intermediate inputs (0.11) are also important but relatively low. The scale elasticity is 1.11, showing a Constant Returns to Scale (CRS). On average, technical efficiency was 0.73, which means that farmers could improve their performance by 27%. Additionally, results suggest that experience and education positively influence the technical efficiency, contrary to age, gender, region and density; whereas, access to extension services and irrigation increases efficiency. Also, general trust and membership in farmer organizations increases efficiency; and, as we expected, risk aversion and probability weighting decreases efficiency. In this regard, it is necessary to design policies and strategies focused on facilitate accessibility to exchangeable inputs; in the promotion of extension services with greater action area; facilitate access to irrigation through subsidies and credits; improve trust in programs and networks; develop cooperative enterprises or local and horizontal organizations to share information and services from farmer to farmer; and also generate action plans to promote a better risk and loss behavior in order to seize technological and economic opportunities and not overestimate extreme events.

Keywords: *Technical Efficiency, Stochastic Frontier Analysis, Cumulative Prospect Theory, Risk preferences, Social Capital, Adaptation to Climate Change, and Vineyard farmers.*

EXPLORING THE POTENTIALS OF CYCLE TOURISM AS A DRIVER FOR RURAL DEVELOPMENT: THE CASE OF WINE ROUTES IN THE MUNICIPALITY OF NEMEA, GREECE

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Abstract

Cycle tourism is now an emerging form of alternative tourism that leads to significant benefits in the areas of sustainable development. Especially, the economic benefits of cycle tourism have greatly attracted the interest of the global tourism industry, policy makers and stakeholders. Hence, there is an ongoing attempt for enhancement of this form, including various policy measures and infrastructure development, giving particular emphasis on rural space. A great contribution will be the integration of cycle tourism into a comprehensive and multidimensional tourism management plan. Greece has not yet shaped the proper conditions for an integrated cycle tourism development, while at the same time the use of bicycles is particularly low. It is promising though that the country's rural network consists of roads with low traffic flow that could be, under specific circumstances, ideal for cycling. In this context and on the basis of building a strong relation between cycling and rural space, this research aims to promote cycle tourism along with the enhancement of the primary sector in the municipality of Nemea. Specifically, the research creates an integrated recreational network, consisting of thematic routes addressed to cycling and walking. These routes connect all the wineries in the municipality as well as archaeological sites, traditional settlements and other points of interest. These routes were determined using Geographic Information Systems (network analysis). Furthermore, this research proposes some policy measures and interventions that can support the development of the network. As a result, Nemea, a rural area pioneering in wine making, is estimated to become an alternative tourism destination, sustaining cycling and traditional products promotion.

Keywords: *Cycle tourism, Rural development, Geographic Information System, Wine routes, Nemea.*

CLIMATE CHANGE AND FOOD SECURITY

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Abstract

Climate change is one of the most pressing challenges facing humanity in the Anthropocene era. It is widely admitted that climate change will have far-reaching impacts including on food security. Therefore, this review paper analyses the multifaceted relations between climate change and food security. In particular, the paper explores the impacts of climate change on the four dimensions of food security (i.e. food availability, food access, food utilisation, stability). It draws upon a review of scholarly literature indexed in the Web of Science. The analysis of the literature shows that there is a dual relationship between climate change and food security; on the one hand, climate change affects all the dimensions of food security and, on the other hand, the quest for food security has implications in terms of climate change. As for food availability and supply, climate change is widely believed to reduce crop yields and livestock productivity especially in the countries of the Global South. Effects on food production and availability as well as the impacts of extreme climate events affect both food physical and economic accessibility. The changes in production systems induced by climate change may induce changes in dietary patterns and food utilisation. Climate change will also affect the stability and resilience of food systems with consequences in terms of long-term food security. Moreover, the quest for food security, through agricultural intensification and agricultural land expansion, increase greenhouse gas emissions from deforestation and land use changes. The intricate relation between climate change and food security makes the case for integrated policies that maximise co-benefits while addressing trade-offs. That is fundamental to make sure that 'climate action' will not jeopardize the achievement of 'zero hunger' and vice-versa.

Keywords: *Climate change, food security, food availability, food access, food utilisation, food system, agriculture.*

CLUSTERS INITIATIVES IN ITALY: CONCEPT AND NATIONAL MODEL OF CLUSTER – SPREADING EXPERIENCE WITHIN “UNICLAD” PROJECT

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Abstract

Clusters are of growing importance in the new global environment in which the Europe 2020 strategy has to succeed. Italy is one of the EU countries with the highest number of cluster organizations, together with France, Germany, etc. Italy is considered as one of the pioneers in cluster formation and creation of cluster policies, with its concept of “*Industrial district*”. As a partner of UniClaD project (Enhancing the capacity of universities to initiate and to participate in clusters development on innovation and sustainability principles - UniClaD) CIHEAM Bari is promoting this strong Italian experience at wide European scale, to help build clusters and cluster-like organizations within agri-food sector out of the EU member countries. Through a systematic review of the literature, mapping of Italian agri-food clusters was performed, with the focus on the Puglia region (Southern Italy). The concept of clusters is in general important for the country, with constant support at the national and regional level to this form of economic/business aggregation. Italy currently holds world leadership positions in the agri-food sector, where “*Made in Italy*” tradition and quality are associated with scientific research, innovation, and development. As an umbrella organization stands National Agri-Food Technology Cluster (Cluster Tecnologico Agrifood Nazionale – CL.A.N.), being an important facilitator in the promotion of collaboration between research, enterprises, and institutions throughout Italy, while at a regional level many clusters and similar organizations are operating and are nodes of sector synergies. Italian experience and clusters importance for the economy confirms that European policymakers cannot afford to ignore their role and should actively explore their potential to modernize and improve economic policies in agriculture, food and agri-industry sectors.

Keywords: *Educational Research, Clusters, R&D and Innovation, Agri-food, UniClaD.*

TABLE GRAPES IN APULIA REGION AND INTERNET OF THINGS: INNOVATION AND SUSTAINABILITY. THE CASE OF THE IOF (INTERNET OF FOOD AND FARM) PROJECT

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Abstract

In a context of increasing economic competition, Italy is certainly the cradle of excellent agro-food products, recognized and appreciated at global level. Among them table grapes play a vital role in the panorama of Italian production, as witnessed by official data provided by ISTAT (National statistical institute) and related institutions. This is particularly true with regard to Apulia region, where the vast majority of production and cultivated fields are located. The need to concile quantity requests with traditional high quality and, as well, with sustainability makes it essential to employ effective ad hoc technological innovations. The adoption of Internet of Things (IoT) devices and, specifically, the creation of an IoT network to monitor the complete supply chain of table grapes, from field to fork, is of great importance and interest. Generally speaking, the mentioned devices and network allow farmers to monitor and optimize the growing behaviour of grapes and ripening, jointly with the amounts of fertilizer and pesticides used, as well as the irrigation process. All these features strongly rely on IoT devices and systems deployed on the field, in the packaging phase and in transportation. The present contribution aims at conducting an in depth analysis of the Internet of Food and Farm (IoF2020) project use case in Apulia region and its implications for the future enhancement of sustainable cultivation of table grapes.

Keywords: *Innovation, Internet of Things, Table grapes, Apulia region, Sustainability.*

EVALUATION OF THE ECONOMIC GAINS OF THE BEE COLONY REMOTE MONITORING

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Abstract

Precision Beekeeping is focusing on individual bee colony remote monitoring using different measurement systems and sensors. One task of the Precision Beekeeping is to continuously collect real-time data about bee colonies for its further analysis with aim to identify different states and abnormal behaviour. In many cases bee colonies have many different parameters available for constant monitoring and the beekeeper should decide what kind of IT system is needed to accomplish this task. Automatic monitoring systems offer many advantages for the beekeepers, but also have their installation price and maintenance costs, so the economic aspect of the IT system implementation should be considered when implementing monitoring system within the Precision Beekeeping. This paper describes possible economic gains while such systems are implemented. Different scenarios are observed and discussed. Return of investment coefficient is calculated as well to find out how fast investments for system implementation of the specific monitoring system will be returned. In addition, to ease the process of calculation of all formulas and evaluate the economic gains of the implementation of bee colony remote monitoring system, online web tool (application) is developed and published for public use. Based on made calculations and assumptions it can be concluded that beekeepers need adjustable bee colony monitoring system for cheap basic measurements of all colonies and one main module for in-deep monitoring of referenced colony within one remote apiary.

Keywords: *Precision Beekeeping, Precision Apiculture, economics of beekeeping, return of investments, SAMS project.*

THE STRUCTURING AND GOOD GOVERNANCE OF THE PULSES SECTOR IN MOROCCO: RESULTS FROM AN E-DELPHI SURVEY

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Abstract

This research aimed to identify potential proposals contributing to the structuring of the Moroccan's pulses sector and improving its governance for food security purposes by examining the issues and key constraints affecting its entire value chain and its future in the next decade. The data were collected from an e-Delphi questionnaire which consisted of 40 proposals submitted to experts and administered in two rounds. The DELPHI method used aimed to reach the consensus of 26 experts selected among the value chain actors of this sector based on a Likert measurement scale. Authors used the agreement percentage (>80%) to measure the level of consensus between experts. Furthermore, authors calculated the mean absolute standard deviation at the median of each proposal to confirm the level of consensus. An analysis of the experts' comments was also used. Findings show 19 new proposals suggested in the first round and added in the second round. Consensus was reached on 39 proposals contributing to the structuring of the sector and on seven proposals aimed at improving its governance. However, the analysis of experts' comments on the future of the sector revealed controversial opinions and did not make it possible to establish scenarios for changes in terms of areas, the share of pulses in crop rotation, national production and commercialization. Such results highlight the need for collective thinking between actors to lay the foundations for a common strategic vision of the sector and its implementation based on good governance.

Keywords: *Value chain, Governance, Food security.*

REALMED PROJECT: SOCIOECONOMIC INSIGHTS AND PROPOSALS FOR MEDITERRANEAN TERRITORIES PROSPERITY

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Abstract

In this paper, we share the results obtained from a socio-economic approach applied in a qualitative case study methodology, about four Mediterranean products: Argan oil from Morocco, *Porco Alentejano* and *Cerdo Ibérico*, from Portugal and Spain respectively, *Djebel Lamb* and Kid from Tunisia, and Truffles from Italy and Slovenia. Those products are connected to vulnerable and specific cultural and environmental hotspots. Due to the high potential market value they can achieve, they may be subject to several frauds and threats. Authenticity and valorisation are then essential engines for the maintenance of local socio-economic activities and of the cultural and natural heritage. We use a variety of data sources, ensuring that we explore the complex issues in a variety of lenses, which may reveal us the associated multiple challenges. We present and integrate all the results we have collected, produced and/or analysed, at the same time explore considerations and insights from other research works, to produce recommendations and best practices, as proposals to apply in future actions. We point out key issues to stimulate rural economies, the exchange and sharing of knowledge and the protection of several stakeholders in the agro-food value chains. Moreover, we propose specific research lines that lead to engage with transdisciplinary methods, highlighting design as a structured working process and a non-technological innovation in the domain of agricultural value chains and applied economy. We consider those prospects vital goals to improve market competitiveness, quality and innovation both in regional, national and global scales.

Keywords: *Innovation, Mediterranean Value Chains, Socio-economic Valorisation, Sustainability.*

A PORK VALUE CHAIN IN PORTUGAL: THE CASE STUDY OF PORCO ALENTEJANO, MONTANHEIRA SYSTEM AND TRADITIONAL PRODUCTS

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Abstract

For the production of the *Porco Alentejano*, an autochthonous Portuguese porcine breed, the *Montanheira* system is a crucial process, corresponding to a period of an intensive pig's fattening in the *Montado*. It occurs between October and March, where the pigs freely consume the acorns. *Montado* is an agro-forestry-pastoral Portuguese system created by the human intervention, which occupies a large part of the territory, being a source of unique products, as the cork and the acorn. *Montado*'s management is a complex process due to its susceptibility to disturbances of soil and *Quercus* trees, and a dynamic between the economic activities and the conservation of this system. The objective of this study is to estimate, along the value chain, the Gross Product of the acorn, the *Montanheira* pig value, and of the fresh meat and final processed products, protected designation of origin (PDO) products. From the secondary information about the *Montado* area, the *Porco Alentejano* herds, and with the information collected in the field works, we estimate and present the results. The pig is the most efficient animal in the acorn conversion, multiplying by ten the economic value of food animal resource. The transformation into high quality traditional PDO hams and shoulders increases about 50% the value of the *Porco Alentejano* reared in *Montanheira*. The joint between the *Montado* and the development of rural areas, where the studied animal rearing takes place, is a good example of the balance between the economy, the sustainability of natural resources and cultural heritage.

Keywords: *Porco Alentejano, Montado, Montanheira, PDO, Sustainability.*

SMALL FARMS' AND AGRICULTURAL HOUSEHOLDS' LABOR PERSPECTIVE, CHALLENGES AND KEY INFLUENCE FACTORS IN ROMANIA

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Abstract

The Romanian agriculture has undergone a long and consistent structural adjustment starting from the EU pre-accession period in the early 2000's continuing with the EU integration period along the first two programming and budgeting periods, from 2007 until the present. One important feature of the Romanian rural economy present along the transition period was the dominance of primary sector, a reality that is still valid nowadays. Inside the sector, one important characteristic is the labour coupled with the social dimension of the agricultural activity and the rural life in general. Most research and analysis references indicate a dual agriculture originating basically in the structure of property and labour input leading, or rather preserving, a highly efficient and modern agriculture with large and very large farms and a second component less competitive, neighbouring the subsistence level and largely populated throughout the labour inputs and structured in small and very small farms and agricultural households. The present paper analyses the labour related evolution of this second category, captures the recent changes and elaborates on the perspective and the challenges driven by the potential shifts of the key influence factors identified as: education - achieved level and system's readiness to provide for the specific sectoral needs, demographics and age structure layered from farm's head to family members, migration pressure from the agri-industry component or other sectors and territorial development gaps. framework factors (land cadastre, property transfers, social support measures, support programs). The projections focus on changes and impact highlighting intervention directions leading to potential policy changes.

Keywords: *Agricultural labour, challenges, change factors, small farms, Romania.*

RWANDA'S JOURNEY TO SUSTAINABLE SMALLHOLDER AGRICULTURE TRANSFORMATION: AN EVIDENCE-BASED ASSESSMENT

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Abstract

The issue of feeding the growing population in a convenient way is a global challenge, but it is more threatening in developing countries like Rwanda where the level of food insecurity and poverty is high. This implies that focusing on agriculture is a must if economic growth, poverty reduction and food security issues have to be dealt with expeditiously. This paper aims at clarifying the Rwandan's path in the quest for a socially, financially and environmentally sustainable agricultural transformation. The results presented in this research have been obtained through an extensive literature review of published peer-reviewed papers and government and non-government agencies reports. This was complemented by a statistical analysis of data on imports and exports, yields and cultivated area, use of fertilizers, inputs subsidies and other economic, social and environmental aspects retrieved from FAOSTAT website and national surveys. The research shows that a conducive policy and institutional environment has been created by various socio-economic, institutional and agriculture-led reforms launched since the early 2000s. Impressive results have been recorded in regard to smallholder agriculture intensification and the theoretical model for progressive smallholder agriculture transformation helped to characterize the progression stages of farmers revealing that most of individual farmers are still subsistence smallholders, while only grouped and resourceful farmers are progressing from the 'commercial smallholders' to 'advanced farmers' stages. The paper, also, reveals a series of challenges that hamper the implementation of smallholder development-prone strategies, and suggests some policy actions to be put forward to address those challenges.

Keywords: *smallholder agriculture, sustainable transformation, strategies, policy, Rwanda.*

MIGRATION DECISIONS AND WELFARE OF MIGRANTS-SENDING HOUSEHOLDS IN RURAL RWANDA: EVIDENCE FROM ENDOGENEOUS SWITCHING REGRESSION MODEL

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Abstract

A rural community economic status is strongly linked to the transition of its population to urban areas and migration effect is obvious in migrants-sending households and communities. This is explained by the fact that if, in the host regions, their standard of living improves, migrants will contribute in improving the livelihoods of their families and communities through remittances and funding of rural development projects. This research aimed at understanding the effects of migration decisions on the welfare of migrants-sending households in rural areas of Rwanda. The analysis used the endogenous switching regression model on data collected in 5033 rural households in 2016/2017 as a part of the fifth nationwide cross-sectional survey on the Households Living Conditions. The major findings showed that regions where the high level of poverty was noted were also experiencing a high level of internal migration with 31.9% and 24.3% in Western and Southern Provinces, respectively. Results also showed that, on one hand, the remittances received from a relative migrant, income level of the household head, number of cattle owned, size of owned land and an increasing level of education were among the factors affecting positively the per capita household expenditures. On the other hand, the income received from migrants was invested in education of children and family health, and allowed to increase the household assets and productive assets. This affirms that jobs availability and livelihoods diversification in host regions are not only improving the migrants living standard, but also their sending-households' welfare.

Keywords: *Welfare, internal migration, rural areas, Rwanda.*

COMMERCIAL BANKS AND THEIR EFFECT ON SMALL AND MEDIUM ENTERPRISES FINANCING IN RWANDA: A CASE STUDY OF KIGALI CITY AND SOUTHERN PROVINCE

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Abstract

Commercial Banks worldwide are identified to be one of the key players in the financial industry that have positively affected individuals involved in business, and the economy at large, through the functions they perform in the economy. However, inadequate financing in the activities of Small and Medium Enterprises (SMEs) is still the major constraint faced by people involved in business activities. Even though the Government of Rwanda has made effort to improve the accessibility to credit, entrepreneurs still have some challenges to access financial services in order to improve their businesses. The purpose of this research was to assess the contribution of commercial banks in financing SMEs in Rwanda. A sample of 60 SMEs was selected in Kigali and Southern Province of Rwanda. Data was collected from the respondents through a structured questionnaire. The collected data were analyzed using descriptive statistics such as frequencies and percentage distributions. A Pearson Chi-Square Test was used to analyze the relationship between commercial banks and SMEs in Rwanda. The results indicated that the main purposes of loan application were start-up capital, working capital and expansion of businesses. The results also revealed that there was positive relationship between commercial banks and SMEs in Rwanda. The results revealed as well, that commercial banks in Rwanda played a crucial role in contribution to SME's economic development and small and medium entrepreneurs who got credit from commercial banks expanded their businesses and increased their income.

Keywords: *Commercial Banks, Small and Medium Enterprises, Entrepreneurs, Chi-square Test, Rwanda.*

ANALYSIS AND FORECASTING OF VEGETABLE PRICES IN SERBIA

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Abstract

The paper presents the analysis and forecasting of prices for seven vegetable crops: potato, bean, tomato, pepper, onion, cabbage and watermelon. The absolute vegetable prices were analyzed for the period 2002-2017, starting thus from the year the euro was introduced. Conversion of the prices into euro was carried out according to the average annual exchange rate of euro, based on the data of the National Bank of Serbia. The analysis of the real prices, which are price parities of certain vegetable crops in relation to bread grain (wheat), was conducted for the whole period 1994-2017. The aim of this analysis was to formulate the relative changes of the economic position of certain vegetable crops in relation to wheat, which is the most important cereal cultivated in our conditions. Forecasting of the prices for certain vegetable crops was made for a five-year period 2018-2022. ARIMA models were used for the forecast, indicating that all average vegetable prices analyzed for the period 2002-2017 will increase significantly in 2022. On the other hand, the average price parities of the vegetables in relation to wheat as analyzed for the period 1994-2017 will not have the same trends in the forecast period as the absolute prices. The bean price parity will improve from 9.1 to 12.3; tomato from 1.9 to 3.5; pepper from 2.3 to 3.

Key words: *vegetables, price, forecast, Serbia.*

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EVALUATION OF FARMS' SUSTAINABILITY ACCORDING TO LAND TENURE (TUNISIA)

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Abstract

In Tunisia as in the world, the main objective of the sustainable agriculture is to improve agricultural systems by creating more wealth and meeting the needs of the population without compromising those of future generations. Within this environmental concern, the current research constitutes an assessment of sustainability level of different farms in Tunisia, in the region of Mornag (delegation of Ben Arous, Tunisia). It is based on the indicators of the Farm Sustainability Indicators (IDEA) method, which provides operational content to the concept of sustainability at the farm level, to compare the level of farm sustainability based on the factor: Land tenure status. We distinguish two groups of farms: on the one hand, private properties, inherited from father to son, and on the other hand, the Society of Agricultural Improvement (SAI), which is state land leased by farmers for long term tenure. The obtained results showed that the impact of land tenure factor is different from one scale to another among the two groups of farms. Private farms are more sustainable on both scales: agro-ecological and socio-territorial. Indeed, they favor integrated systems and the production of field crops and fodder crops. In addition, they give more importance to the training of employees and the reception of trainees. On the other hand, they are less sustainable on the economic scale mainly because of the "Transferability" indicator for which the SAI recorded the best averages thanks to the transferability of the assets which is managed and guaranteed by the State.

Keyword: *Land tenure, Sustainability, Agriculture, Tunisia.*

EFFECT OF ANIMAL HUSBANDRY ON FARMS' SUSTAINABILITY, MORNAG REGION, TUNISIA

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Abstract

Sustainable agriculture is an application of the concept of sustainable development to the agricultural sector and more specifically at the farm level. It takes into account the three dimensions - economic, social and environmental - in a global framework. It is in this context that this study aims to assess the effect of the integration of livestock into the production system on the sustainability of farms in the Mornag region, located in the northeast of Tunisia. Two groups of farms were derived: with livestock and without livestock. The Farm Sustainability Indicators (IDEA) method was used to meet this research objective. From the analyses of the previous results and the comparisons between the means of the indicators of each component according to the mode of production, we were able to deduce that this factor considerably influences agricultural sustainability on both agro-ecological and socio-territorial scales. Indeed, the group of farms that include livestock have better averages in most indicators. These results could be explained by the fact that the association of crops with livestock within a production unit is considered an asset in the sustainability of an operation since it allows positive interactions and synergies between the different elements of the system. Indeed, in the mixed crop-livestock system, the diversification of production, crop rotation and the use of animal manures contribute to improving soil fertility. In addition, animal husbandry makes it possible to diversify income and distributes it over time and, therefore, ensures a certain stability in the economy. Some farmers even have a daily income from animal products such as eggs and chickens; others take advantage of some products for family consumption.

Keywords: *Sustainability, Farms, Livestock, Tunisia.*

DETERMINANTS AND STRATEGIES OF FARMERS' ADAPTATION TO CLIMATE CHANGE: THE CASE OF MEDENINE GOVERNORATE, TUNISIA

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Abstract

Climate change is a worldwide environmental issue to all economic sectors, mainly the agricultural sector. Tunisia is one of the countries adversely affected by climate change because of its low adaptive capacity. Adapting to climate threat is the main goal of farmers, who are the primary stakeholders in agriculture, to increase the resilience of their farming systems. Based on a survey between March and May 2018 with 100 agricultural households from the governorate of Medenine, which belongs to Southeast Tunisia, this paper examined the main adaptive measures to climate change used by farmers, the factors influencing their choice of measures and the constraints to adaptation. To explore the factors affecting the choice of adaptive measures, this study employed a multinomial logit regression. Results showed that irrigation, crop diversification, integration of crop with livestock and shifting from farm to non-farm activities were the main adaptive measures implemented by farmers in the study area. Further, the multinomial logit model indicated that the factors influencing the choice of adaptive measures included household head age, access to extension services, household income, number of years of experience of the household head in agriculture, and the distance to the market. The results demonstrated also that adaptation to climate change was hindered by many factors such as constrained resources, lack of money, and water shortage. The findings of this research suggest the need for improving the access to extension services, to water, and to means of production to enhance the resilience of vulnerable agricultural households and to improve their wellbeing.

Keywords: *Climate change, adaptive measures, agricultural households, multinomial logit regression, governorate of Medenine.*

DIGITAL LAND MANAGEMENT AS A FACTOR FOR IMPROVING AGRO-ECONOMY EFFICIENCY

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Abstract

Land has always held a special place among other resources used in agriculture. Therefore, the efficiency of the agro-economy depends on the quantity and quality of the land resources used. The total world reserves of agricultural land are about 5 billion hectares (of which arable land - 1.4 billion hectares). The Russian Federation has 9.5% of the world's arable land and the country has a high level of land availability. In Russia, there are about 12 hectares of territory per person, including 1.3 hectares of agricultural land and over 0.8 hectares of arable land, while the world average is 0.14 hectares of arable land per person. Despite this, modern land relations in Russia do not ensure the rational use of land resources and high efficiency of agricultural production. This situation takes place, among other things, due to the low quality of land resources. Thus, in Russia, up to 100 million hectares are subject to desertification processes in 20 regions of the Russian Federation. About 60% of agricultural land is located in the erosion hazard zone. Russian black soil has lost 20 to 50% of its humus in different parts of the country, but it remains the most fertile soil in the world. There are other problems as well. Land management is a traditional tool for Russia to ensure a more rational use and protection of land resources, the implementation of state land policy with the ultimate goal of increasing the efficiency of agriculture. Smart land management is a new trend to improve the efficiency of agro-economy. Formation of a modern scientific and technological base for rational planning, forecasting (economic and technological, informational), management and legal support of digital (smart) agricultural land use requires solving complex scientific problems of a fundamental and applied nature, including: (i) improving and developing modern methods of managing agricultural land ownership and land use, (ii) studying soil and agroecological characteristics of agricultural land using digital mapping technologies and innovative software for space and unmanned aerial vehicles, (iii) forecasting, planning and organization of use of land resources, (iv) improvement of land legislation, etc., (v) formation and controlling of legal support for smart land use, etc., (vi) development of a technological platform for involving unused agricultural land in the turnover.

Keywords: *Land resources, Efficiency of agriculture, Digital land management, Russia.*

SMART LAND MANAGEMENT FOR THE DEVELOPMENT OF ORGANIC FARMING SYSTEMS

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Abstract

Organic agriculture is a system that, compared to traditional agriculture, has such major advantages in sustainable development as food safety and public health, as well as food security in general. Technologies used in the production of organic products provide, in particular, the abandonment of the use of agrochemicals, pesticides, antibiotics, growth stimulants, hormonal preparations, etc. In Russia, on January 1, 2020, the Federal Law came into force regulating the production and circulation of organic products in the country. The Russian organic market, in comparison with the foreign one, is at the initial stage of development and in value terms over the past 15-20 years the market volume has grown tenfold. Indeed, at present, there are positive changes in the growth of organic production in Russia, but the country's land and natural resources allow the country in the medium term to become one of the important players in the global organic products market. An important role in solving this problem is played by the digitalization of agriculture and the creation of "smart land use" based on technologies of "smart land management". The development of the industry through such components as "smart field", "smart farm", "smart greenhouse", "smart garden", etc., should be considered in the overall system of functioning of an agricultural organization. The currently applied methods of assessing and planning productivity in organic farming systems should be based on a complex (systemic) multivariate analysis of relevant geospatial information in order to make operational and effective management decisions. Smart land management allows many tasks, including such as: increasing the accuracy of estimation and forecasting of productivity in agriculture with almost 100% probability; significantly increase the yield of agricultural crops and reduce production costs, for example, by automating the accounting of all factors of production of organic products; develop and implement an effective system of anti-erosion and environmental protection measures for organic agriculture, etc.

Keywords: *Organic agriculture, Smart land management, Russian organic market.*

THE STUDENTS ECOLOGICAL CULTURE AND GREENMETRIC UNIVERSITY RANKING

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Abstract

There are various global university rankings designed to measure the performance of universities around the world. Among the most famous are such ratings as QS World University Ranking, the World University Ranking, Ranking Web of Universities or Webometrics Ranking of World Universities, and others. Each of them has its own goals and objectives, as well as its own methodology. QS is based on a methodological framework that employs six parameters to represent university performance: academic reputation (40%); employer reputation (10%); faculty/student ratio (20%); citations per faculty (20%); international faculty ratio/ international student ratio (5%). The THE ranking has analyzed 13 indicators in five areas: teaching (the learning environment); research (volume, income, and reputation); citations (research influence); international outlook (staff, students and research); industry income (knowledge transfer). The Webometrics ranking parameters are: presence (5%) (size; number of websites) of the institution's main web domain; visibility (50%) (number of external networks originating backlinks to the institution's websites); transparency (10%) (number of citations from Top authors according to source); excellence (or scholar) (35%) (number of papers in the top 10% most cited in 26 disciplines). However, none of these rankings measure environmental policy making in universities. The UI GreenMetric World University Ranking is the answer to this important question. The UI GreenMetric rating was developed at Universitas Indonesia in 2010. It classifies about 800 universities from over 80 countries and adopts the concept of environmental sustainability, which includes three elements: environmental, economic and social. These elements are measured by the following six indicators with their weights: setting and infrastructure (15%), energy and climate change (21%), waste (18%), water (10%), transportation (18%), education and research (18 %). The conducted research has shown that the participation of our university in this rating has become a condition and factor of a significant increase in the ecological culture of students.

Keywords: *Higher Education, Green University Rankings, Ecological Culture.*

7. FORESTRY AND AGRO- FORESTRY

TYPOLOGY, PRODUCTIVITY AND DYNAMICS OF ALEPPO PINE STANDS IN THE OUARSENIS MASSIF (ALGERIA)

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Abstract

Aleppo pine is the most important forest species in Algeria. This species has been used for a long time in reforestation programs, notably the green dam around the 1970s. Despite this importance, the Aleppo pine continues to undergo all kinds of degradation such as land clearing, illegal cutting and fire. This situation is causing reduction of potential wood production, also jeopardizing the vitality of the stands and their regeneration. Our work aims to describe the typology, productivity and dynamics of Aleppo pine stands in the Ouarsenis massif (West of Algeria). 30 plots were installed to describe the stands (composition of forest species, DBh, total height, basal area). Regeneration was estimated by the rate of juvenile stage (Dbh<5cm). The results obtained shows that the Aleppo pine develops different conditions for altitude, climate and type of soil. These conditions have a direct influence on the structure of the Aleppo pine and its productivity. The best populations develop on an average altitude (500 to 1400 m), in subhumid and semi-arid climates, on southern exposures and on limestone soils. The stands are mostly young (age <70 years) with good natural regeneration. These results put focus on the factors of degradation of the Aleppo pine, in particular the recurring fires and the lack of silvicultural management which can improve the productivity and the vitality of the stands.

Keywords: *Aleppo pine, Ouarsenis massif, productivity, stands dynamic.*

POSSIBILITY OF ESSENTIAL OIL RATIONAL PRODUCTION FROM GREEN PARTS OF CONIFER TREES ON THE ROMANIJA MOUNTAIN (BOSNIA AND HERZEGOVINA)

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Abstract

Forests on the mountain Romanija (Entity of Republic of Srpska, Bosnia and Herzegovina) are rich in conifer species (*Abies alba*, *Picea abies*, *Pinus silvestris*, *Pinus nigra*) presenting the base of the growing stock with 134.000 m³ of annual cut. After timber harvesting in forest there are side products as well needles, strobiles, offshoots and branches mid-diameter 1 – 4 cm that do not have any use, but they are actually the raw material for essential oil production. Using the survey, data were collected from the forest management unit „Romanija“ Sokolac, public enterprise of forestry „Šume Republike Srpske“. The questions referred to the basic data about the FMU and quantity of wood assortment placed on the market selected by tree species. From green parts of conifer trees 2.000 tons per year (50% of total mass) in the period 2005-2014 and a middle yield coefficient at the beginning of vegetation and at the end of the growing season $Y_{Ce\Delta} = 0,3725 \text{ cm}^3 \text{ oil} / 100 \text{ g}$ it is possible to produce annually about 7.456 liters of high quality and market desired essential oil. The production is seasonal because of the most intensity during of vegetation and the end of the growing season. The available raw material should be processed in six months that is 13.333 kg raw material per day. Using the 10 distillers with a capacity of 300 kg per load distillation can be realized 5 – 6 loads per distiller per day if 20 workers are doing the job for 12 hours per day. Gross income is based on a product price of €1,02 / 10 ml and the annual value is about €536.118 – 1.003.029.

Keywords: *essential oil, conifer, yield, gross income, the mountain Romanija.*

MORPHOLOGICAL VARIABILITY OF LEAVES OF SILVER-LEAF LINDEN (*TILIA TOMENTOSA* MOENCH.) IN BOSNIA AND HERZEGOVINA AND SERBIA

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Abstract

Silver-leaf linden (*Tilia tomentosa* Moench.) is considered as a valuable tree species in the context of climate change due to its adaptation to dry and warm conditions in Central and Southeastern Europe. It is also highly valued in horticulture. The study aims to determine the interpopulation and intrapopulation variability of leaves of silver-leaf linden in Bosnia and Herzegovina and Serbia. In this research, authors have collected silver-leaf linden leaves from the Sana river valley (two localities), the Neretva river canyon (two localities), and “Fruška Gora” National Park (two localities), including 30 trees per locality, and 30 leaves per tree. Research team have measured: petiole length, blade length, blade width, the distance of the first right developed nerve from the base of the blade, angle of the first right nerve with the central nerve of the leaf, length of the central nerve, and counted the number of primary teeth per 1 cm of leaf length. Analysis of variance showed statistically significant differences between populations, while Duncan’s test showed the separation of populations into separate groups for most traits. According to the countries of origin, the analysis of variance showed statistically significant differences between countries for all traits, except for the trait distance of the first right developed nerve from the leaf base. Bearing in mind that silver-leaf linden is a species adaptable to climate change, melliferous and valued in horticulture, it is necessary to expand morphological research to a higher number of populations and to conduct research at the molecular level.

Key words: *morphological traits of leaves, silver-leaf linden.*

STRUCTURAL AND PRODUCTION CHARACTERISTICS OF THE MOST IMPORTANT FOREST TYPES IN FOREST ENTERPRISE "VISOCNIK" (BOSNIA AND HERZEGOVINA)

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Abstract

The paper presents comparative analyzes of the tree number, volume and height of edificators (fir, beech and spruce) in three different production forest types (management classes). The aim is to study the production and structural characteristics of the various types of forests in investigated area of Visocnik. Primary data of taxation was collected (DBH above 10 cm and three heights as well) for all trees with DBH above 10 cm as their heights as well. After that the stand volume was calculated. According to this results of the research, the height curve was to the most homogeneous. The lowest heights were recorded by European beech in the investigated production forests types (management classes), while similar height curves were determined for spruce and fir. The height curve was deviates at most in the management class 1210 (forest type of European beech and fir on a series of limestone predominantly deep soils). The height was from 11m to 34m. In management class 1210 was recorded the highest number of fir tree as well as volume. Tree number and volume are more uniform for management class 1208 and 1209. In this management class the differences are determined for European beech. The number of Eueopaeen beech trees is 16 and the volume is 23,08 m³. The natural rejuvenation is the most perfect form of the regeneration of the stands because the stand regenerated in that way contains the continuity of stability and productivity inherited by the former mother stand.

Key words: *Fir, Spruce, European beech, management classes.*

FIRST RESULTS OF STUDY OF VEGETATIVE SEED PRODUCTION GARDENS FROM ATLAS CEDAR/CEDRUS ATLANTICA L. / IN BULGARIA

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Abstract

It is essential for the enrichment of the forest fund in Bulgaria to have a continuous study of the introduction of valuable exotic species, which also increases the productivity of forests. One of the valuable coniferous introduced trees for the Black Sea coast of Bulgaria and Stara Zagora region is the lowest cedar / *Cedrus atlantica* L. /. In-depth study will be done on a plantation in Stara Zagora, in the nursery Zora. In the process of work, the following will be done: comparison of results in terms of seed germination, and morphological features of the cones. In the process of research, field measurements have been used, and in terms of material collection, the processes related to the measurement of cones have been performed at the university. The aim is to compare the results with similar data and identify deviations or similarities. The results of the analyses will help to validate more the results or identify problems contributing to the lower germination rate. All the data obtained from the research give us a way to continue the in-depth study of the Atlas cedar, namely: state of cultures; what is the influence on the Atlas cedar of the climatic and soil features of the studied areas; study of the variability of seed yield and the features characterizing its structure; determination of the sowing qualities of the seeds produced in the study area; identification of signs determining reproductive ability; establishing the dependence of seed productivity and seed quality on the conditions of formation and the external environment.

Keywords: *Atlas cedar, Seed production, Condition of Cedar crops.*

EXAMINATION OF THE CONDITIONS OF FOREST SHELTERBELTS IN DISTRICT DOBRICH (NORTHEASTERN BULGARIA) USING GIS

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Abstract

The state forest protective belts established in the Dobrudzha plateau (Northeastern Bulgaria) in the early 50s of the last century have had an immense and lasting business and ecological impact. Apart from blocking winds and decreasing soil erosion, the shelterbelts keep soil moisture, and improve soil fertility and agricultural yields: thus supporting the sustainability of agricultural activity in the region. Shelterbelts have remained in the possession of the state even after Bulgaria's political transition to democracy; that ensured that protective belts (along with their beneficial functions) remained physically intact and at their original geographical locations. Nowadays shelterbelts' well-being is affected by property disputes, by illegal logging, and by poor agricultural management and maintenance of sanitary conditions. One way to decrease the effects of the latter problems is to introduce a state-of-the-art database software system for managing spatial data of shelterbelts. Using Geographic Information Systems (GIS) technology, we developed a unified information system for forestry protective belts based on data from Forest management plan of our chosen forest area (State Forest Enterprise "Dobrich", district Dobrich). We classified shelterbelts by type, by development scheme, by tree species and origin, by age, and by other indicators. We built database queries in GIS environment and obtained aggregated data on the shelterbelts from the territory of the SFE "Dobrich". Using automated algorithms, we identified potential sites of illegal activity and areas endangered by landslides and already affected by flooding or fire. The results of our analysis are the basis of adequate solutions for the protection of shelterbelts in the district. We have developed thematic and interactive maps that can be accessed via free GIS platforms. We have improved preparedness and response speed of forestry organs by integrating our data and tools into their operations. The end result is a boosted efficacy in the efforts to conserve forest protective belts.

Keywords: *GIS, forestry, protective forest belts.*

INDIGENOUS DRYLAND AGROFORESTRY SYSTEM FOR BIODIVERSITY CONSERVATION AND CARBON STORAGE IN TIGRAY, NORTHERN ETHIOPIA

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Abstract

Agroforestry (AF) is an age-old practice in the farming system of Ethiopian dry lands. So far, several studies conducted in the field of AF have been focused on system design, soil fertility management and system interactions. Less emphasis has been given to the biodiversity and climate change mitigation aspects. The objective of this paper was to evaluate the woody species diversity, biomass carbon (C) and soil organic carbon (SOC) stock of the dry land indigenous AF practices. A total of 197 smallholder farmers representing four AF practices were systematically selected from lowland, midland and highland. Woody species inventory was done on the randomly established plot of each farm. A total of 59 species, belonging to 48 genera and 32 families were recorded. Shannon diversity index (H') of highland agroecology was higher in-home garden AF, while in the midland and lowland the higher H' was recorded in parkland AF. Smallholding ecosystem C stocks (sum of total biomass C and SOC 0–60 cm) ranged from 77 to 135 Mg ha⁻¹. The mean total biomass C stock of woodlot AF practice (31 Mg C ha⁻¹) was significantly higher than the other three AF practices. SOC stocks (0–60 cm) were greater in boundary planting (113 Mg C ha⁻¹) followed by the home garden (109 Mg C ha⁻¹) and woodlot (97 Mg C ha⁻¹) AF practices. Finally, our work concluded that home garden and boundary agroforestry could strategically promote maximization of biodiversity and carbon storage of the dry land ecosystem.

Keywords: *Boundary planting, home garden, parkland, resilience, woodlot.*

MECHANISMS FOR SUCCESSFUL BIOLOGICAL RESTORATION OF THE THREATENED JUNIPERUS PROCERA (CUPRESSACEAE) ON DEGRADED LANDSCAPE, ETHIOPIA

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Abstract

Juniperus procera Hochst. ex. Endl. (Cupressaceae) is world's largest juniper, but is currently threatened owing to multiple anthropogenic factors. This paper describes mechanisms for the successful biological restoration of African pencilcedar in a degraded landscape that had been depleted of organic matter and essential nutrient elements as a consequence of relentless deforestation, soil erosion, unsustainable farming and overgrazing. We used stecklings (= planting materials derived from rooted cuttings) of *J. procera*, and deployed *Acacia abyssinica* Hochst. ex Benth. (Fabaceae) to serve as a putative foster tree. The study was conducted for a period of 7 years, with major soil fertility indicators determined at years 0, 3 and 7. We found that mean height, crown length, crown diameter, branch length, and branch numbers of *J. procera* trees grown in association with *A. abyssinica* were significantly ($p = 0.001$) higher than those grown without the putative foster tree. Mean plant-available P (15 ± 2.1 ppm) and soil N-content ($0.42 \pm 0.04\%$) were approximately 3- and 2-fold higher, respectively, in the *A. abyssinica*-treated plots than in the non-treated ones. Similarly, the levels of exchangeable cations and soil organic carbon were twice higher in the *A. abyssinica*-treated plots than in the non-treated ones. Cation exchange capacity improved with restoration time, both in the 0–15 and 15–30 cm soil profiles, but the extent of improvement was significantly ($p = 0.001$) higher in the 0–15 cm soil profile of the *A. abyssinica*-treated plots than in the non-treated ones. We conclude that successful restoration of *Juniperus procera* in degraded landscapes and across the species' range of habitats was feasible provided that strong and well-fortified stecklings were established along with the N₂-fixing, fast-growing and drought-tolerant *Acacia abyssinica*.

Keywords: Center for Indigenous Trees, Highlands, Mountainous region, Soil fertility, Tulu-Korma, Stecklings.

ETHNOBOTANICAL STUDY OF MEDICINAL PLANTS USED TO TREAT HUMAN AILMENT IN GUDURU DISTRICT OF OROMIA REGIONAL STATE, ETHIOPIA

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Abstract

This research was carried out to document ethnobotanical data and threats affecting medicinal plants. Semi-structured interviews, questionnaires, face to face discussion, and field visit was employed to gather the required data. A total of 92 informants (21 key and 71 randomly selected informants), of which 48 males and 44 females, participated. The study documented 57 plants species belonging to 55 genera and 41 families. Of these families, *Asteraceae* were represented by 4 species (7.123%), followed by *Euphorbiaceae*, *Fabaceae* and *Rutaceae* which was represented by 3 species each. The majority of the species 40 (70%) was gathered from natural habitats while 26% was cultivated and 4% collected from both. The most widely utilized plants were: Trees 19 (33.3%) species, followed by shrubs 18 (31.6%) species, herbs 16 (28.07%) species, and climbers with 3 (5.3%) species. The society also frequently used plant parts such as fresh plant materials (68%) and leaves (33%). The most widely used route of medicine application was oral (58%), dermal (23%) and nasal (10.5%). The remaining remedies were taken with some other additives and solvents like water, butter, milk as well as honey. Traditional medicines were prepared by pounding (33.3%), and crushing (24.6%). *Carduus schimper* and *Ocimum forskolei* was medicinal plants with higher informant consensus. The disease classes with highest ICF rate (0.93) were fibril illness. The result revealed that there was high preference for *Ficus vasta* for healing Hemorrhoid disease whereas *Cissus cactiformis* was used for treatment of Rabies by traditional medicine practitioner. *Ekebergia capensis* was the highest multipurpose tree species.

Key words: *Ethnobotany, Guduru district, traditional practitioner, medicinal plants, ailment.*

EVALUATION OF SOIL QUALITY PARAMETERS IN SILVOARABLE SYSTEMS

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Abstract

Agroforestry is considered a sustainable cultivating methodology in comparison to intensified and one-dimension agriculture, resulting in higher yields, socio-economic benefits and environmental protection as well. The silvoarable systems constitute classification of the agroforestry systems that involve crops and trees in the same spatiotemporal scales. One of the most important benefits related to the productivity of silvoarable systems is the maintenance or improvement of soil quality. In the present study, qualitative characteristics of soils in traditional silvoarable systems in the area of Mouzaki, central Greece, were studied through the determination of basic soil parameters, including the organic matter content, total nitrogen, exchangeable potassium and available phosphorus. All systems under investigation were characterised as boundary hedgerows (livefences). The trees in the hedgerows may include mulberry, wild pear, wild walnut, and other wild tree types typical of the Mouzaki landscape, whereas the understorey crops were both arable and horticultural. Within the research areas, the effect of the trees on the concentration of the selected soil parameters was investigated. Soil samples were collected in all systems at two depths (0-30 and 30-60 cm) and at three distances from the selected trees, corresponding to half, twice, triple or quadruple the tree canopy width. The results of the research provided evidence of C sequestration in all soils under investigation, thus indicating the positive effect of agroforestry systems on the environment.

Keywords: *Traditional agroforestry systems, Silvoarable systems, Soil fertility, Organic matter, Macronutrients.*

LONG-TERM RELATIONSHIP BETWEEN OAK DECLINE AND SHRUB GROWTH DYNAMICS IN AN HUNGARIAN OAK FOREST, 1972-2017

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Abstract

Long-term structural dynamics of shrub layer of temperate oak forest communities were not extensively reported in published studies. The serious oak decline was first reported in 1979-80 and nowadays 63.0% of canopy oak trees died in a forest stand. The data were used to obtain (1) quantitative information on shrub layer growth, including height (H) and shoot diameter (DSH) condition and basal area (BA) values; (2) structural information on foliage cover rate of the shrub layer, mean cover of some shrub species; (3) comprehensive description from the ecological processes in the shrub layer in the last 45 years and our objective was (4) to analyze the possible effects of oak decline on the shrub growth dynamics. The following measurements were carried out in the 48 × 48 m plot: shoot height, shoot diameter, basal area and foliage cover of each individuals in the high shrub layer. Correlation analysis confirmed that significant positive relations were between mean H, mean DSH of the dominant woody species (*Acer campestre*, *Acer tataricum* and *Cornus mas*) and oak tree density between 1972 and 2017. The decreasing oak tree density did not show detectable impact to the co-dominant shrubs growth. There was a low significant association between number of oak trees and basal area of high shrub layer. Finally, there was a statistically significant interaction between mean cover of *A. campestre* and *C. mas* and oak trees. The findings of the study indicate that forest responded to oak decline with significant structural rearrangement in the shrub layer.

Keywords: *Acer campestre*, understory, height, diameter, mean foliage cover.

PLANT DIVERSITY IN TREE STRATA AND ITS RELATION TO SOME FEATURES OF BEECH STAND IN HYRCANIAN FORESTS

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Abstract

For this research, field data from 24 circular 400 m² sample plots in the inventory grid of 100 m × 150 m were used in beech stand, northern Iran. For characterizing tree-layer diversity, tree-layer species richness (SR), Shannon–Wiener diversity index and Hill's evenness index were used. Diameter and height of beech trees were measured per sample plot. Herb-layer species richness (herb-layer SR) was estimated in each plot. Litter and humus layer thickness were measured at center and 4 corners of sampling points. Result showed that a total of 7 tree species including *Fagus orientalis*, *Carpinus betulus*, *Alnus subcordata*, *Tilia begonifolia*, *Acer velutinum*, *Acer cappadocicum* and *Prunus avium* were recognized in 24 plots. Totally, 23 herbaceous plants belonging to 21 families were found distributing in different plots within forest which higher life form was presented by Hemicryptophytes. There was a significant difference between dominant and codominant layers regarding to tree species richness (SR) and Shannon-weaver diversity index ($P < 0.01$), and higher mean values belonging to dominant layer. The herb-layer richness correlated significantly with litter thickness, whereas there was no correlation between other factors. SR of tree layer was negatively and significantly correlated with DBH and height of beech trees and Shannon's diversity and Hill's evenness indices of tree layer were negatively correlated with beech frequency.

Keywords: *Tree strata, Diversity, Beech forest, Herb-layer, Hyrcanian region.*

AMOUNT OF ENERGY WOOD RESOURCES IN DRAINED FORESTS AND ABANDONED AGRICULTURAL LANDS IN LATVIA

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Abstract

The amount of wood as a renewable energy resource is an important indicator of the economy. Traditionally, forestry and the national economy consider the amount of timber obtained in the main use of the forest and in thinning. However, opportunities to obtain additional wood resources from other forest elements, such as understorey and undergrowth, which have hitherto been considered illiquid, are increasingly being considered. Drained forests are suitable for this type of study because they have sufficient soil fertility so that understorey and undergrowth, as well as the felling residues, should not be left in the area to maintain the soil fertility, and, because of soil properties, not have to be used to strengthen the bottom of the timber logging roads. As another potential source of energy wood in the country is abandoned agricultural land overgrown with woody plants. The study also provides information on the amount of these resources by comparable tree dimensions. For the assessment of energy wood resources at the national level, the data of the State Forest Resources Monitoring from 1723 monitoring plots in drained forests and from 608 plots in abandoned agricultural areas located in a regular network in the whole territory of Latvia have been used. To have the data about the mass of individual woody plants by species and elaborate the mass models, 27 sample plots have been established in drained forest stands, as well as 12 sample plots in abandoned agricultural lands. Calculated on country level, in drained forest site types the highest average biomass of understorey and undergrowth plants has been obtained in *Mercurialis* mel. and *Oxalis* turf. mel. forest site types – 10.55 and 7.96 t ha⁻¹ respectively. The biomass of woody plants on an overgrown agricultural land at ten years of tree's age has reached 16 t ha⁻¹.

Keywords: *Energy wood, Drained forests, Abandoned agricultural land, Latvia.*

PRE-TREATMENT AND INVESTIGATION OF WHEAT STRAW AND HEMP SHIVES FOR BINDER-LESS FIBREBOARD PRODUCTION

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Abstract

Wood-based panels (WBP) comprise a considerable part in the output of the European wood industry, GDP, and export. Over 30% of fibreboards and about 50% of other boards used in constructions and carpentry are produced in Europe. Industrially produced WBP contain synthetic adhesives determining mechanical properties and being made from oil are often toxic present health risks. Synthetic adhesives may comprise up to 15 % of the total WBP mass and up to 60 % of the total production costs. Production costs of WBP are important under the circumstances of rising oil prices. Moreover, synthetic bonding agents rather often is a source of emissions of formaldehyde and another problems with advancement of WBP solutions being offered by synthetic adhesives without formaldehyde (polymeric methylene diphenyl di-isocyanate – PMDI), or by natural adhesives from renewables (e.g., tannins or soy flour), or by pre-treatments activating bonding agents contained in the source material. The availability of raw materials for WBP is still another problem under the circumstances of the rate of population growth exceeding the rate of the regeneration of wood resources. Expanding the diversity of raw materials for production of WBP by utilization of agricultural residues containing components like wood is one of the possible solutions. The present study is aimed at development of technology of binder-less fibreboards made of steam-exploded agricultural residues, such as wheat straw (*Triticum aestivum* L.) and industrial hemp (*Cannabis sativa* L.) shives. Some aspects of the study, like differences in chemical composition, thermal properties of raw and pre-treated materials potentially affecting binder-less fibreboard bonding, presented.

Keywords: *Wheat straw, Hemp shives, Steam explosion pre-treatment, Binder-less fibreboard.*

BIOLOGICAL PECULIARITIES OF *CYDALIMA PERSPECTALIS* (WALKER, 1859) IN THE CONDITIONS OF THE REPUBLIC OF MOLDOVA

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Abstract

The box tree moth *Cydalima perspectalis* (Walker, 1859) (Lepidoptera: Crambidae), dangerous pest boxwood plants in East Asia (China, Japan and Korea), is currently officially present in 35 countries of the Europe. In the plantations of *Buxus sempervirens* in the central zone of the Republic of Moldova, a new invasive pest *C. perspectalis* was revealed in several localities. As a result of studying the biological peculiarities, it was found that the phytophage develops in the republic in three generations, wintering at the stage of larvae of 2-3 ages. The flight of imago in spring begins in May, the next generations appear in the middle and end of summer. Flight of imago and oviposition can continue until September-October with overlapping generations. The development of eggs at a temperature of $+ 25 \pm 2$ °C continued 3-5 days on average, the development of larvae was 20-36 days, the stage of the pupa – 12 ± 1.0 days. Lowering the temperature increased the duration of each stage. Moldovan populations box tree moth, as well as all the other populations described earlier from Asia and Europe, have several different types of wing colouring – typical (white), intermediate and melanic morphs. Pest monitoring is required to control population density. To manage the density of pest populations, it is necessary to use both traps with sex pheromone and microbiological and chemical preparations, depending on the situation.

Key words: *Cydalima perspectalis* (Walker, 1859), invasive species, biological peculiarities, life cycle, monitoring pest density.

EFFECT OF STRATIFICATION ON SEEDS GERMINATION AND SEEDLING GROWTH OF *FAGUS SYLVATICA* L.

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Abstract

The European beech (*Fagus sylvatica* L.) is one of the most important broadleaved species in European forestry, which grows in the Republic of Moldova on approximately 1,450 hectares of natural protected areas. Beech is propagated by seeds, but its seed formation is irregular. Therefore it is necessary to store the seeds and to obtain a high germination percentage, which could be maximised by cold stratification. The aim of our research was to study the germination of *Fagus sylvatica* L. seeds after cold stratification by following characteristics: germination energy; total germination; coefficient of speed germination; mean daily germination; mean germination time. The beech seeds were exposed to stratification at a temperature of $+4\pm 1^{\circ}\text{C}$ and a humidity of 30%. The seeds germination started on tenth day and continued during three months. The maximum of germination energy (calculated on 30th day) and total germination was equal to 27.0 and 72.3%, respectively. Mean germination time was 55.48 ± 5.72 days, and coefficient of speed germination constituted 1.72 ± 0.24 . The germinated seeds were sown and the bio-morphological features of beech seedlings were studied in nursery condition. The period of seedling appearance after sowing of germinated seeds was minimum 10 days, maximum 29 days. The proportion of grown seedlings from germinated seeds was about 69.2%. A clear dependence of seedling number on stratification time of beech seeds was not established. The chlorophyll index of seedling leaves after 45 days of growth was determined and compared with a similar leaf index in adult plants of European beech.

Keywords: *Fagus sylvatica* L., seed, stratification, germination, seedling growth.

SOCIO-ECONOMIC CONTRIBUTIONS OF FOREST RESOURCES TO LIVELIHOODS IN ALIMOSHO LOCAL GOVERNMENT AREA OF LAGOS STATE IN NIGERIA

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Abstract

There is an increasing understanding that forests play crucial roles in sustaining livelihoods among the rural communities and is a key element in poverty reduction strategies. This study assessed the socio-economic contributions of Forest Resources to Livelihood in Alimosho Local Government Area of Lagos State through a random selection of two hundred (200) respondents interviewed with a questionnaire with both open and closed ended questions to elicit needed information on respondents' socio-economic and other relevant characteristics. The data gathered were collated and analyzed using regression analysis and frequency distribution. The findings showed that more than half (63%) of the respondents were females aged from 15 to 50 years; a greater part (76%) were married with average of 5-10 persons in their households. All respondents (100%) had one form of formal education or the other and were engaged in different forms of vocation. Regression results confirmed that access to forest products was associated with household's characteristics such as age, position in the household, level of education and distance to the forest all indicating significant relationship with forest access and utilization of forest resources. Households' dependence on forests and activities they engaged in also had a significant impact on the forest in terms of conservation and sustainability of forest resources. The study concluded that forest resources played vital roles in the livelihoods of the respondents and recommended that more attention should be given to forest resources conservation by the government and assistance should also be given to foresters in the form of subsidy.

Keywords: *Forest, Livelihoods, Socio-economic, Lagos, Sustainable.*

SOCIO-ECONOMIC SURVEY OF FOREST FOODS IN AFIJIO LOCAL GOVERNMENT AREA OF OYO STATE, NIGERIA

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Abstract

Forest supplies diverse products and services to mankind especially in the area of wild plants and animal food products. This research involved a socio-economic survey of forest foods in Afijio Local Government Area of Oyo state, Nigeria. The specific objectives were to identify and describe the socioeconomic characteristics of the respondents; to identify the available edible forest wild plants; to determine the contribution of forest foods to nutrition and food security among the respondents as well as to identify and describe major problems facing forest foods collection. Primary data were collected from 150 respondents selected through random sampling techniques from seven Districts of the Local Government. The data were analyzed using descriptive statistics, logit regression and Pearson Correlation Coefficient. The findings showed that a greater part of the respondents (58%) were male and 87% of the respondents were married. The results revealed that 47% of the respondents were in their active ages between 41-60 years and 76% of the respondents had family size of 1-5 persons. The study further revealed that over whelming majority of the respondents made use of forest food products. The major problem encountered by forest products users was the unavailability of forest food products in the off season. Based on the findings, it was suggested that, there should be provision of good storage facility and orientation of the farmers on modern ways of preserving wild foods to make them available throughout the year.

Keywords: *Logit Regression, Forest Foods, Wild Plants, Storage, Afijio.*

IMPLEMENTING THE HIERARCHY-ANALYTIC PROCESS WITHIN FOREST FRUITS FROM MUREȘ COUNTY, ROMANIA

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Abstract

Romanian forest ecosystems prove their true value through the complex diversity they offer. Varied relief forms, site conditions, temperate climate and the stand composition and structure elements sustain the apparition of vegetation layers and their population with diverse forest species that accentuate biodiversity. The economy from Romania’s forest area is improved by the increased potential of harvesting a limited number of wood or non-wood products in order to ensure the population’s needs and wellbeing. The activity of trading forest goods is encouraged by the maintenance of a good collaboration with international companies. The purpose of the present research is to analyse the most appreciated forest fruits from Mureș County, România. A total number of eight forest fruits were selected from the non-wood products category and were distributed in the following classes: achene (acorn, hazelnut), false fruits (rosehip), pluri-drupes (raspberry, wild strawberry), pseudo-beny (pulp cones from *Juniperus* L Genus.), drupes (*Prunus* Genus) and benyform drupes (black elder). The analytic hierarchy process was used in the evaluation of the qualitative and quantitative criteria. Based on it, eight alternatives were attributed to each analysed fruit using 19 evaluation criteria. The Expert Choice Desktop software was used in order to emphasize the performance efficiency. As such, the most valuable forest fruits from this area proved to be *Rosa canina*, *Rubus idaeus* and *Fragaria vesca*. In regard for the harvesting of non-wood products, managers from the forest sector must take into account analyses that can evaluate the offered economic potential, especially in particular cases.

Keywords: *analytic hierarchy process (AHP), Expert Choice Desktop, harvesting period, market, forest fruits.*

RESOURCES OF WOODY PLANTS OF BEECH FORESTS IN NORTH CAUCASUS

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Abstract

The object of the research is phytocenoses where beech was predominant in the composition. The experimental plots were located in the Central part of the North Caucasus, on the territory of the Republic of North Ossetia-Alania (Kartcinsky ridge), at the altitudes within range from 1200 to 1350 m. Two experimental plots were located on the northern and two on the southern expositions. The main purpose of our research was the financial evaluation of wood resources "deposited" as the main components of the beech forests of the North Caucasus. The characteristics of phytocenoses in the experimental plots were gathered based on the results of a continuous enumeration of trees in the test area of 50x100 m in size. In order to characterize underbrush and undergrowth (their composition and distribution by height groups), as well as the living ground cover, we used circular registration plots of 10 m². The average wood stock in experimental stands was about 300 m³/ha, and the average stand density was 248 trees per 1 ha. The average number of underbrush is 8988 examples/ha, and undergrowth is 1998 examples/ha. The average height of the undergrowth was 0.65 m, and the underbrush was 0.86 m. The weight of an average height plant in the air-dry condition was 0.24 kg for undergrowth and 0.55 kg for underbrush. Phytomass of undergrowth and underbrush among different species was determined by measuring them in both fresh and air-dry conditions. The financial estimation of all resources was conducted using average market prices for those resources. The main income that could be obtained from the sale of wood was about 650 thousand rubles/ha. The undergrowth and the underbrush could provide an income of a total of 43 thousand rubles/ha. It should be kept in mind that the period of wood maturation for exploitation regarding beech and other related species is 100-140 years. During this period, 15-20 crops of undergrowth and underbrush can be grown. Under the canopy of a beech stand, these components can be restored in 5-8 years. Thus, together, the underbrush and the undergrowth can generate income comparable to that from wood.

Keywords: *The North Caucasus, the components of forest phytocenosis, the resources of the beech forests.*

ESTIMATING INDICES OF SPATIAL FOREST STRUCTURE ON DIFFERENT TYPES OF SAMPLES ON SAMPLE PLOTS IN SERBIA

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Abstract

As a consequence of different influences, all changes in the forest are reflected through spatial structure. Indices of spatial forest structure quantify the condition, spatial relations, and changes in stand. The aim of this study was to examine the conditions of the application of spatial indices. In this study data from four equal sample plots in Serbia were used. Each sample plots was 0,20 acres in size. Spatial patterns of tree position in stands of Serbian spruce, Macedonian pine, Beech and Hungarian oak were investigated. Indices based on structural groups of reference trees and the nearest neighbors (4) were used for the analysis (CE , Wi , Mi , Td , Ud). The samples were divided into two groups. The first, control group, consisted of samples with the inclusion of the nearest neighbors located close to the plot boundaries, *plus sample*. The second group consisted of samples without additional recording, *minus sample*. Differences were tested at a significance level of 5% by the appropriate test (Paired T-Test). The analysis results show a statistically significant difference of the values of the spatial arrangement individual (CE , Wi) based on different samples. Other spatial structure indices (Td , Ud , Mi) does not shows a statistically significant difference. Indices of the spatial pattern of trees without additional recording (CE' , Wi') show higher values than indices from control group on all sample plots. Other index groups do not show a clear direction in relation to the type of samples. When determining the spatial structure index (CE , Wi) it is necessary to make edge-corrections with some of the existing methods. Therefore, for these indices, it is necessary to perform additional recording of trees outside the boundaries of the sample plots.

Key words: *indices of spatial forest structure, edge-corection, forest structure, Serbia.*

EFFECTS OF EXTENSIVE SILVOPASTORAL SYSTEMS ON POPLAR PLANTATIONS PRODUCTIVITY AND INVASIVE SPECIES DISTRIBUTION

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Abstract

Results of traditional silvopastoral systems applied as grazing livestock in poplar plantation are shown in this research. These systems have been widely implemented in research area of Forest management unit of Kupinski kut. The poplar plantations productivity and invasive species distribution have been analysed in two management types: with and without livestock grazing. Two sample plots with livestock grazing have been selected with regards to time of abandonment of livestock grazing in poplar plantation. The findings are based on the dominant, valuable, selected and healthy trees. Dominant stems in poplar plantation without livestock grazing have shown smaller coefficient of variation of breast diameter (8,19%) and stem height (3,97%) compared with the experimental plots with traditional grazing, but with the higher coefficient of variation in canopy length (15.69%). The canopy layer in the plantation has been found on poplar trees. In shrub layer in experimental plot without livestock grazing, we have detected two invasive species *Amorpha fruticosa* and *Acer negundo*. The former species has been differential comparing to experimental plot with livestock grazing in cover and its grouping. The most dominant species in herbaceous layer was *Rubus caesius* while the most dominant differential species recorded in experimental plot without grazing were *Amorpha fruticosa* and *Acer negundo*.

Key words: *poplar plantation, livestock grazing, invasive species.*

Acknowledgment: This research was implemented in project DTP2-096-2.3 - Sava TIES.

RISK MANAGEMENT IN ACCORDANCE WITH THE PRINCIPLES OF INTERNATIONAL CERTIFICATION AND STANDARDIZATION IN FORESTRY

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Abstract

Risk management in forestry is a generic process of identification, analysis, evaluation, and decision making. Decision management and risk management in forestry are conditioned by the need to analyze the general environment (economic, ecological, social, technological and political-legislative). The process of standardization and international certification for wood intensifies in Serbia. Management of complex systems such as forestry is demanding to supervisory assessment and the establishment of risk management processes. By implementing the process of risk management according to ISO31000, forestry can have multiple benefits in the area of achieving business goals, better compliance with relevant legislation and international standards, improving management, planning, and more efficient use of resources. The process of risk management uses interactive matrices and analyzes 140 parameters. This paper aims to present the methodology of harmonization of legislation at the operational level with management functions in forestry through the process of risk management to make forest management environmentally friendly, socially acceptable, and economically sustainable.

Keywords: *forestry, risk management, standard, certification.*

THE ABILITY OF VEGETATIVE REPRODUCTION OF HORNBEAM IN THE PROCESS OF NATURAL REGENERATION OF THE SESSILE OAK FORESTS IN NORTHEASTERN SERBIA

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Abstract

Hornbeam is one of the most represented undergrowth species in the sessile oak stands in the area of northeastern Serbia. In this paper, a comparative analysis of the growth characteristics of three-year-old and four-year-old sessile oak seedlings and three-year-old and four-year-old hornbeam shoots and root suckers in the sessile oak stand in the area of Majdanpek in northeastern Serbia was performed. From the aspect of phytocenological classification, the stand is defined as an association of sessile oak with hairy sedge (*Carici pilosae – Quercetum petraeae* B. Jov. 1989) on eutric brown soil on neutral and basic eruptive rocks. The combination preparatory and seed cut was conducted in 2013 when the undergrowth of accompanying tree species (white linden, hornbeam, common ash) was removed, together with individual dead sessile oak trees. Subsequently, a large number of shoots and root suckers of species from the undergrowth (mostly white linden and hornbeam) appeared and affected the growth and development of the sessile oak seedlings. The average number of hornbeam shoots per one stump was 6.5 and of root suckers 4.0. Compared to the average height of three-year-old sessile oak seedlings, the average height of three-year-old shoots was 125.6 cm higher, as for root suckers, 131.2 cm higher. Compared to the average height of four-year-old sessile oak seedlings, the average height of four-year-old shoots was 174.7 cm higher, as for root suckers, 198.9 cm higher. Differences in heights indicate a significant lag in the growth of sessile oak seedlings in comparison to the shoots and root suckers of hornbeam, which can significantly affect the outcome of the regeneration of these stands.

Keywords: *Northeastern Serbia, Vegetative propagation, Hornbeam, Sessile oak, Natural regeneration.*

THE DEVELOPMENT OF SEEDLINGS AFTER THE SHELTERWOOD REMOVAL CUT IN THE SESSILE OAK STAND IN NORTHEASTERN SERBIA

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Abstract

This paper presents the analysis of the development of seedlings after the shelterwood removal cut in the sessile oak stand in northeastern Serbia. The stand is phytocenologically defined as an association of sessile oak with hairy sedge (*Carici pilosae - Quercetum petraeae* B. Jov. 1989) on eutric brown soil on neutral and basic eruptive rocks. The stand is located at an altitude between 290 and 320 m, on slope up to 20°, and western - southwestern exposure. The shelterwood cuttings were done in two stages. The first was combined preparatory and seed cut in 2010 (after abundant acorn production in 2009), when the undergrowth of accompanying tree species was removed, together with individual dead sessile oak trees. The removal cut was performed at the end of 2016. After the removal cut, the development of seedlings in full light conditions was analyzed over the next three years. At the end of the vegetation period in 2017, the average number of 8-year-old seedlings per m² was 13.4, the average height of seedlings was 55.8 cm and the average diameter was 7.1 mm. At the end of the vegetation period in 2018, the average number of 9-year-old seedlings per m² was 13.2, the average height of seedlings was 78.4 cm and the average diameter was 8.7 mm. At the end of the vegetation period in 2019, the average number of 10-year-old seedlings per m² was 12.0, the average height of seedlings was 106.1 cm and the average diameter was 10.4 mm. The obtained results indicate very intensive development of the seedlings after the shelterwood removal cut.

Keywords: *Northeastern Serbia, Sessile oak, Shelterwood cutting, Development of seedlings.*

NORTHERN RED OAK (*QUERCUS RUBRA L.*) IN BELGRADE (SERBIA)

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Abstract

In order to properly select plant species, especially dendroflora as the basis of different categories of open green spaces, of great importance is to know the characteristics of development, vitality and decorativeness of already grown specimens in similar environmental conditions. One of the very interesting species for Belgrade region is northern red oak (*Quercus rubra L.*) Northern red oak is species that occurs naturally in a wide area in eastern North America (USA and Canada) and which Extent of Occurrence is estimated at over 4,150,000 km² According to Nature Serve, it is on the list as globally safe (G5) species, which current population trend is stable. Introduced to Europe in 1691, it currently covers over 350,000 ha, being found all over the continent, except the coldest part of Scandinavia It is also grown as an ornamental tree in the parks. Of the varieties, the most common is *Q. rubra* var. *maxima*, more rarely *Q. rubra* 'Aurea'. According to the experience from Serbia, *Q. rubra* is easily adapted to different climatic and other conditions. It is suitable for habitats of sessile and common hornbeam forests, mountain beech forests and forests of Hungarian and Turkey oaks. It is relatively fast growing, tolerant of soil conditions. It does not tolerate stagnant water and floods, as also dry land. It tolerates shade better than native oaks. The species is resistant to low temperatures and polluted urban environments. In Serbia, it is found both in forest ecosystems, as well as in the urban areas. This tree is often planted in some urban forests in the area of Belgrade, but also on different categories of open green spaces. The paper presents the researching results of development, vitality and decorativeness of this species at five sites, in different environmental conditions.

Keywords: *Quercus rubra L.*, *Belgrade*, *urban conditions*, *development*, *landscaping*.

MORPHOLOGICAL CHARACTERISTICS AND CONTENT OF HEAVY METALS IN FRUITS OF DIFFERENT BLUEBERRY VARIETIES

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Abstract

The research was conducted in a blueberry plantation in the village Božurnja situated in the western part of Serbia. The paper deals with morphological parameters of the blueberry fruits such as: medium fruit diameter (mm), fruit mass in fresh and dry condition (g), respectively, and water content in the fruit (%), as well. Content of some heavy metals in the fruits such as Zn, Cu, Pb, Cd, Fe, Mn has been also examined. Statistical processing of collected data was performed according to descriptive statistics, one factor analysis of variance and LSD-test. The aim was to determine fruit quality of two blueberry varieties (*Duke* and *Huron*) based on above mentioned elements. As for recorded heavy metals, their content was very low and therefore with no significant effect on the quality of fruit. Among all researched heavy metals, the greatest concentration was recorded for Fe, while the least was recorded for Cd. Low concentrations of Zn and Mn, as the elements with a significant role in all physiological processes in the plants, could affect a bit yield of the fruits. Based on the obtained results, it can be deduced that *Duke* has larger fruit than *Huron* variety. All in all, it can be said that quality of the fruits of both analysed blueberry varieties is satisfactory. Having in mind that blueberry fruits have a lot of medical properties, it is necessary to establish more plantations with this useful species.

Keywords: *blueberry varieties, Božurnja, heavy metals, fruit characteristics.*

VASCULAR FLORA IN THE FUNCTION OF RED DEER FEEDING IN MEADOWS WITHIN BOSUT FORESTS

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Abstract

Red deer occupied a lot of forest areas in the past in Serbia, but due to human activities, it gradually disappeared. The process of reintroduction of red deer is still ongoing. For that reason, it is very significant to examine floristic composition of meadows which includes effects of many different factors such as: orography, soil, climate, vegetation. Red deer uses bark of hornbeam and beech in order to satisfy its food needs. It should be emphasised that the importance of some meadow representatives is related to the fact that they contain much more nutrients and have much higher energy value compared to the bark of above mentioned species. The research was conducted at the area of Bosut forests in order to determine abundance of herbaceous plants that are used for red deer feeding. Three localities were selected as experimental plots – one situated in dry (road between two departments) and the other two in wet (Dubovci puddle and Fish puddle) site conditions. Based on the obtained results, it can be deduced that much richer floristic diversity was recorded on wet than on dry localities – this is particularly related to species from families *Poaceae* and *Fabaceae* as the most important for red deer game feeding.

Keywords: *vascular flora, red deer, meadow communities, Bosut forests.*

IMPORTANCE OF TESTING THE DYNAMIC MODULE OF DEFORMATION ON FOREST ROADS

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Abstract

Intensive development of forest road infrastructure through the construction of new and reconstruction of existing forest roads, requires fast and quality methods for assessing the quality of performed works. In order to ensure the long-term functioning of the forest road, its bedrock and aggregates must provide a solid and stable base. During the construction of forest roads, it is necessary to control the performed works constantly in order to ensure that the road construction materials are sufficiently compacted to ensure this condition. The road construction of the forest road must be able to withstand the loads arising from traffic. This bearing capacity is often influenced by the degree of compaction, the moisture content and the type of soil on which the road is built. The practice of examination of the degree of compaction has been present for a long time in our civil engineering, but apart from individual cases, it has not found wider application in the construction of forest roads. The paper presents the importance of testing the dynamic modulus of deformation on forest roads and gives an overview of the research conducted so far using a dynamic plate with a falling weight. The research was conducted on four forest roads in different parts of Serbia, whose road construction was built of stone aggregate of shale, peridotite and limestone. Testing of the dynamic deformation modulus was performed with a dynamic plate of the brand ZORN type ZFG 3.0 GPS. Average values of E_{vd} on forest roads ranged from 29.5 MN/m² to 50.4 MN/m².

Key words: *forest roads, road construction, bearing capacity, dynamic module of deformation, E_{vd}.*

IMPACT OF EXTREME CLIMATE FACTORS ON FORESTS DROUGHT IN REPUBLIC OF SERBIA

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Abstract

This study presents the results of the impact of extreme climatic factors on the occurrence of forest drought in the Republic of Serbia. Drought is certainly one of the most dominant abiotic stressors. Due to prolonged periods without rainfall and high air temperatures, drought can disrupt normal functioning of even completely healthy plants. Drought represents direct and indirect factor that will influence on occurrence of forest dieback. It refers directly to dieback of entire plants or parts of plants, while indirectly it is reflected in the appearance of different pathogens that will attack the weakened plants due to its action. During the 16 years of research (2004-2019) on this topic, it was concluded that the great droughts in the Republic of Serbia is caused by the drought occurred after several consecutive years of its presence (2011-2013). At the first moment, these damages were even recorded as damage caused by an unknown cause, while through comparing with defoliation, the number of died and almost died trees and the climatic characteristics of the studied period, it reach a conclusion on the real causes. Due to such extreme weather factors, tolerance thresholds have been exceeded, leading to their gradual decay. Another good indicator of the impact of the drought is the large incidental yields in the total yield, within the companies dealing with forest management, that have arisen in the period after extreme climatic factors, in this case droughts. We can see many advantages of the continuous monitoring method at a large number of ICP sample plots, because the monitoring of phenomena and processes over a longer period of time and on a larger number of samples allows more precise identification of the true causes of the forest dieback. If the symptoms that occurred in isolated trees, can also be diagnosed in a closer environment, then it is even easier to conclude on the true causes of the dieback.

Key words: *ICP sample plots, monitoring, drought, Serbia.*

PRELIMINARY TESTS ON PREDILECTION OF *PHYLLOBIUS OBLONGUS* AND *CHAITOPHORUS LEUCOMELAS* ON CLONES OF WHITE POPLAR

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Abstract

The prevalence of European Snout Beetle (*Phyllobius oblongus* L.) and poplar aphid (*Chaitophorus leucomelas* Koch) has been studied in the first growing season of experimental plantation in experimental estate of „Kačka šuma“ of Institute of lowland forestry and environment, University of Novi Sad, Serbia. Four white poplar clones were tested: Villafranca, L-100, L-80, and L-12. The plantation was established at the beginning of 2019 at the site where in previous year-old black poplar plantation had been cut. The assessments of the pests attack were performed in the mid May 2019 on five shoots on three plants per each of three blocks of each of four clones for *Phyllobius oblongus* L., and on three plants per each of three blocks and each of four clones for *Chaitophorus leucomelas* Koch. According to the results of hierarchical analysis of variance and Tukey's test for the percentage of undamaged leaves, there was significant difference between examined clones in prevalence of *Phyllobius oblongus* L. Significantly stronger attack was found for clones L-80 and L-12 than on Villafranca and L-100. In case of *Chaitophorus leucomelas* Koch., the prevalence was assessed according to the percentage of damaged shoots. The differences between examined clones were significant, where the strongest attack was found on clones Villafranca and L-100, and the weakest on clones L-80 and L-12. Results of this study are important especially in context of evaluation of clones L-12 and L-80 that are yet in the experimental phase. Also, the intensity of the attacks of two pests suggest need for considerable concern for pest attack on young white poplar plantations.

Keywords: *Phyllobius oblongus*, *Chaitophorus leucomelas*, predilection, *Populus alba*, clones.

COMMUNITY OF ECTOMYCORRHIZAL FUNGI IN MATURE PEDUNCULATE OAK STAND

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Abstract

Pedunculate oak (*Quercus robur* L.), well known for its long-lasting and durable heartwood, in Republic of Serbia occupies the largest area in the Srem District. This species is host of ectomycorrhizal fungi which are important part of belowground biodiversity and responsible for functioning of forests. The aim of this study was to analyse community of ectomycorrhizal fungi in mature 145- year-old pedunculate oak stand in forest administration “Morović” under management of Public Enterprise “Vojvodinašume”. Ten soil samples were taken with the soil corer in May 2019. Identification of the fungal partner in ectomycorrhiza was performed by combining morphological and anatomical characterization of ectomycorrhizal root type with molecular identification approach, based on sequencing of the ITS rDNA region. Majority of ectomycorrhizal types were identified with molecular methods, since morphological and anatomical descriptions of ectomycorrhizae of these fungi did not existed in the literature. Seventeen ectomycorrhizal types were recorded at investigated site. *Clavulina cristata* (Holmsk.) J. Schröt., *Inocybe putilla* Bres., *Lactarius quietus* (Fr.) Fr., *Lactarius subumbonatus* Lindgr., *Pachyphloides nemoralis* Hobart, Bóna& Conde, *Russula bresadolae* Schulze, *Russula laeta* F.H. Møller& Jul. Schäff. and *Russula melitodes* Romagn. were identified to the species level, and *Clavulina* sp., *Humaria* sp., *Tomentella* sp. and *Tuber* sp. to the genus level. With only morpho-anatomical methods were identified: *Cenococcum geophilum*, *Russula* sp. and *Tomentella* sp. while two ectomycorrhizal types remained unidentified. Species composition of studied ectomycorrhizal community differed a lot from the ectomycorrhizal fungal species previously recorded in young pedunculate oak stand.

Keywords: *ectomycorrhizae, Quercus robur L., diversity, sequencing, Morović.*

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VOCs CONTENT IN FOUR COMMON BOREAL TREE SPECIES FROM FRUŠKA GORA MOUNTAIN IN SERBIA: IMPACT ON HUMAN HEALTH

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Abstract

The VOCs are known to have multiple positive effects on human health, including but not limiting to lowering blood pressure, blood sugar, increasing production, proliferation and activity of cancer-killing cells, known as “Natural killer cells or just “NK cells” and other benefits. Such effects are commonly categorized under the term “Forest therapy”. This study was conducted in order to examine the genetic potential of four tree species in mountain Fruška Gora (Serbia) and their capacity of production and natural evaporation of VOCs. This study serves as a basis for further research of the possibility of various tree species to positively impact human health. Leaf samples from three genotypes of each analyzed tree species (*Picea abies* (L.) H. Karst., *Tilia parvifolia* L., *Pinus sylvestris* L., *Pinus nigra* L.) were collected from the same location in Fruška gora during 2019. Volatile constituents were analyzed by Headspace-GC/MS to determine presence of different VOCs in collected material. The results showed presence of multiple VOCs (Monoterpene hydrocarbons, Oxygenated monoterpenes, Sesquiterpene hydrocarbons, Oxygenated sesquiterpenes, Aliphatic compounds) in each species, but examined coniferous trees (*Picea abies*, *Pinus sylvestris*, *Pinus nigra*) dominated in diversity of found VOCs, particularly in monoterpenes, over one examined deciduous species (*Tilia parvifolia*). It is suspected that mostly monoterpenes, such as α -Pinene, α -Terpinene, Limonene and others have positive impact on human health. Considering this, based on the results of this research, greater potential for human health improvement in terms of genetic traits and VOCs content of examined species lies in coniferous trees. To make a conclusion on suitable tree species for development of Forest therapy, further research on other tree species with qualitative analysis of VOCs and biological impact of these substances on human health is highly needed.

Keywords: VOCs, Human health, Forest, Ecosystem services, Phytoncides.

RESULTS OF MULTIANNUAL MONITORING OF TREE CROWN CONDITION ON ICP LEVEL II PLOTS IN AUTONOMOUS PROVINCE OF VOJVODINA (SERBIA)

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Abstract

Forests are threatened by numerous biotic and abiotic damaging factors. Continuous monitoring of forest conditions is of great importance for detecting changes in forest ecosystems and determining the cause and relationships between the resulting changes and factors that affect forests. The first symptom of forest dieback is the appearance of defoliation of trees. This paper presents the results of several years of monitoring of trees defoliation of sessile oak and pedunculate oak, on two ICP level II plots. First plot was in sessile oak forest on Mt Fruška Gora in Serbia and second plot was at pedunculate oak stand near town Odžaci. Data were collected according to ICP Forests protocols from 2010 to 2019. In addition, impact of biotic and abiotic factors harmful to the condition of the trees was evaluated and analyzed. Significant level of tree defoliation was found in trees of sessile oak and pedunculate oak. At pedunculate oak we noted a low percentage of trees without significant defoliation. During the 10-year period, 7.5% of sessile oak trees and 12.5% of pedunculate oak trees died out. Investigation showed a very strong insect defoliators and oak lace bug attack influence on the results of defoliation assessments of sessile oak and pedunculate oak trees.

Keywords: *monitoring, crown condition, defoliation, insects.*

ECOLOGICAL VITALITY OF CONIFERS ON HABITATS OF DIFFERENT TYPES OF FORESTS IN THE AREA OF BELGRADE AND THE POSSIBILITY OF THEIR FUNCTIONAL AND PLANNING SUSTAINABILITY

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Abstract

Artificially raised coniferous stands in the forest area of Belgrade are located on a total area of 501.91 ha, which represents 3.1% of the total forest area. Today, these stands are found in a large number of localities: Lipovica, Košutnjak, Avala, Zvezdara, Jajinci, Topčiderske šume, Kosmaj, Stepin lug, Gročanska ada, therefore, in the immediate narrower urban zones and zones of multifunctional content, in terms of environmental protection and multi-purpose needs of the inhabitants of Belgrade. Artificial stands that were found at these sites are: black pine, white pine, Douglas fir, larch, soft pine, cedar, spruce and Serbian spruce. The largest areas are covered with black pine, white pine, spruce, etc. These species are most often introduced in habitats of these typological affiliations: forest type of the Hungarian and Turkey oak (*Quercetum frainetto-cerridis typicum*) on brown and brown lessive soil, forest type of the sessile oak, hornbeam and Turkey oak (*Carpino-Quercetum petraeae-cerridis*) on brown lessive soil, forest type of sessile and Turkey oak (*Quercetum petraeae-cerridis*) on brown lessive pararendzin soil, forest type of Turkey and Virgiliana oak (*Orno-Quercetum cerridis-virgilianae*) on deeper leptic calcisol, forest type of common oak (*Tilio-Quercetum crassiusculae typicum*) on shallow to medium deep carbonate chernozem, forest type of sessile oak and hornbeam (*Quercus-Carpinetum*) on deep brown soils, forest type of common oak (*Tilio-Quercetum crassiusculae typicum*) on leached chernozem, forest type of pubescent and Virgiliana oak (*Orno-Quercetum pubescentis-virgilianae*) on pararendins on lessive, etc. Black and white pine in all habitats of these types of forests show significant ecological and coenological stability and vitality in relation to other conifers. The difference is evident between white and black pine, depending which forest type habitat they are located on, which is certainly crucial in planning and fulfilling specific contents related to the functional purpose.

Keywords: *Forest types, coniferous species, ecological vitality, functional planning.*

ECOLOGICAL-COENOLOGICAL VITALITY OF SCOTS PINE ON HABITATS OF DIFFERENT TYPES OF FORESTS IN THE PARK-FOREST "KOŠUTNJAK" IN BELGRADE, SERBIA

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Abstract

Scots pine in secondary habitats in the Park-forest "Košutnjak" is located on two types of primary forest habitat: -Turkey oak, Sessile oak and hornbeam forests (*Carpino-Quercetum petraeae-cerridis typicum*) on cambisol; Turkey and Virgiliana oak with black ash (*Orno-Quercetum cerridis-virgilianae typicum*) on shallow to deep pararendzina on loess (drycambisol). On habitats of Turkey oak, Sessile oak and hornbeam forests (*Carpino-Quercetum petraeae-cerridis typicum*) on cambisol, artificially established stand of Scots pine, at the age of 60 years, has a complete canopy. Average stand height in this age is 18 m and average stand diameter is 30 cm. On habitats of Turkey and Virgiliana oak with black ash (*Orno-Quercetum cerridis-virgilianae typicum*) on shallow to deep pararendzina on less (drycambisol), at the age of 60 years, artificially established stand of Scots pine has a thinned canopy. Stand is devastated with more dynamic progressive succession. Average stand height is 12.4 m and average stand diameter is 19 cm. Scots pine in the secondary forest habitat of more mesophilic type character (*Carpino-Quercetum petraeae-cerridis typicum*) on cambisol, shows the ecological and coenological vitality and adaptability to the specific site conditions. The forest habitat type of more xerothermic character (*Orno-Quercetum cerridis-virgilianae typicum*) on shallow to deep pararendzina, in the same age of Scots pine, is of poorer vitality and adaptability to specific stand conditions. In other words, ecological-coenological and coenological vitality of Scots pine is out of optimum and functional ecological coenological durability.

Keywords: *Scots pine, forest type, ecological vitality, coenological vitality.*

ANALYSIS OF ECOLOGICAL-COENOLOGICAL VITALITY OF BLACK PINE AND RED OAK ON HABITAT OF FORESTS TYPE OF TURKEY AND VIRGILIANA OAK IN THE PARK-FOREST IN BELGRADE (SERBIA)

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Abstract

Considering the specific purpose of park-forest “Košutnjak” in Belgrade (Serbia), originating from spatial-orographic location and prioritized direct needs of citizens of Belgrade for multifunctional content, related to various ecological, social and wellness functions, as well as its subsequent functional planning projection and its legal regulations, park-forest “Košutnjak” has been organized according to plan into three prioritized functional units that have been established based on evaluation and estimate of valorization elements related to concrete purpose. In that regard, the largest surface area is projected to be related to the social function as the most prominent function, based on immediate needs of citizens of Belgrade, and especially based on valorization elements that are related to providing complete content. In accordance with its purpose, these functional units contain largest number of allochthonous and autochthonous tree species, related to primary typological habitats, as well as species belonging to secondary habitats. Considering all these, projection of this research was primarily aimed towards functional sustainability of concrete purpose and therefore, ecological-coenological vitality of black pine and red oak on habitat of primary forest type of Turkey and Virgiliana oak (*Orno-Quercetum cerridis-virgilianae*) on pararendzina was analyzed. Red oak (*Quercus rubra* L., *Q. borealis* Michx f., *Q. borealis* (Marsh.)) on this habitat of primary forest type exhibits significant ecological-coenological dominance, compared to black pine. At the same age, red oak achieves significantly larger production effects and is more stable in ecological-coenological sense. Dynamism of succession differs, that is, black pine is being suppressed by primary types of species (edificators). This is an important insight for projection of following functionally sustainable management plans. That mostly pertains to validity of future planned actions in regards to black pine on this type of forest habitat.

Key words: *Red oak, black pine, ecological vitality, coenological vitality, functional sustainability.*

A 328-YEAR OAK TREE RING WIDTH CHRONOLOGY FROM FLOODED LOWLAND FOREST: THE LONGEST CONTINUOUS TREE RING RECORDS TAKEN FROM LIVE OAK IN SERBIA

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Abstract

Pedunculate oak (*Quercus robur* L.; QURO) is long living and high-sensitive tree species to climate conditions. Old and healthy QURO specimens are rare across its entire distribution range in Europe. These old trees are valuable data-logger about climate and stand conditions into its tree rings. Within the Sava River catchment area in Serbia, only a few QURO trees have survived for more than three centuries. The longest QURO tree-ring-width (TRW) chronology (328 years, spanning the 1685–2013 period) was taken from the strict nature reserve “Stara vratična” (19.245556 E; 44.916111 N) located in a flooded area by Sava River, nearby Morović village. The QURO TRW chronology varied throughout 328 analyzed years, whereby the strongest radial increment was noted in the juvenile tree growth phase, but this was not a suitable climate proxy. In the mature tree growth phase, higher radial increment was noted around 1785, followed by 1800s and 1830s, and finally 1920s, 1950s, and 1970s. On the other hand, the lowest radial increment peaks were observed in 1760 and 1770, and longer periods were noted in the decades after 1850 and 1990. Based on the detrended TRW chronology, TRW productivity decreased more prominently in the 18th and 19th centuries relative to the intensive oak mortality and lower TRW decreasing was noted after 1990s. In particular, strong decreasing trends which were noted in the second part of 18th and in mid-19th centuries, as well as after 1990s were in line with the large-scale TRW decline waves across Europe in the past. These results point to similarities in the reconstructed climate (on a large scale) and QURO TRW decline waves across European oak forests with our results. These indicate that the analyzed locality is in line with large-scale TRW- and climate-patterns and could be a reliable tool for gaining a deeper understanding of historical trends in oak forest productivity and its stand conditions in Serbia.

Keywords: *Tree ring, Radial increment, Oak, Quercus robur, dendrochronology.*

CHARACTERISTICS OF HUMOFLUVISOL SOIL IN THE MIDDLE DANUBE REGION AND ITS PRODUCTION CAPACITY FOR POPLAR CULTIVATION

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Abstract

The paper presents the physical and chemical properties of humofluvisol soil. The survey was made on a geographical stretch from Novi Sad to Titel, in the area of the embankment protected part of the alluvial plain of the Danube. The granulometric composition of the pedological profiles examined shows the highest fraction of fine sand fraction, which averages from 44.39 to 59.98%. The average content of total sand from 45.28 to 61.64%, that is, the content of total clay from 38.36 to 54.72%. The textural classes of the surveyed soils are in humus A horizon up to a depth of 45 cm: loam and silty clay loam, and in the lower parts of the profile depths from 40 cm to 210 cm: clay loam, loam, sandy loam, loamy sand and sand. The pH values increase with depth, ranging from 7.96 to 8.31, which classifies them in moderately alkaline soils. The humus content is highest in the surface humus A horizon from 1.94 to 4.60%, that is, it is weak in this horizon to very humus soils. The average humus values are in the range of 1.71 to 2.43%, so they are weak to moderately humus soils. According to the granulometric composition, the tested soil has favorable water-air properties, with wetting exclusively through groundwater. The production potential of this soil is optimal for the plantation production of a different range of black poplar clones.

Keywords: *Humofluvisol, Granulometric composition, Hydromorphic soil, Danube.*

LEVEL AND QUALITY OF GROUNDWATER IN EUGLEY SOIL OF THE CENTRAL DANUBE BASIN

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Abstract

The paper examines hydromorphic soils of the gley soil type class, eugley soil type. The tested soils are located in the protected part of the mid-Danube River basin. According to the chemical properties of the tested soils, the pH value averages from 7.60 to 8.23 and increases with depth. The total water-soluble salts of the tested soils had average values of 0.13 to 0.19%. The granulometric composition shows an increased average content of total clay, while the texture classes are loam and clay loam. The influence of the Danube water level on the groundwater level is reflected in the high correlation coefficients, which range from 0.72 to 0.92. The measured groundwater level ranged from a maximum value of 30 cm deep to +20 cm above the ground surface. The minimum groundwater depth measured was from 37 to 110 cm. The variation of groundwater during the year ranged from 55 to 80 cm. Groundwater quality classes according to U.S. Salinity Laboratories move in the spring from C3S1 to C3S3, in the summer from C4S2 to C4S3 and in the fall from C3S1 to C4S4. Groundwater quality has been declining between spring and fall. Poor groundwater quality can affect the salinisation and alkalization of the surveyed soils.

Keywords: *Eugley, Groundwater level, Groundwater quality, Danube.*

**MIXED FORESTS OF BEECH AND SESSILE OAK (*QUERCO PETRAEAE-FAGETUM MOESIACAE* GLIŠIĆ 1971) IN KOSMAJ PROTECTED AREA (SERBIA)
– FLORISTIC AND EDAPHIC CHARACTERISTICS**

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Abstract

The paper presents floristic and edaphic characteristics of a mixed forest community of submontane beech and sessile oak (*Quercus petraeae – Fagetum moesiacae* Glišić 1971.) in the protected area of Kosmaj (Serbia). The vegetation of the small mountain massif of Kosmaj is composed of forest plant communities whose edificers are different species of oaks and beech. In the investigated area, this community occurs on calcareous-silicate rocks. The following types of soil were determined: ranker, eutric cambisol, and luvisol. The floristic composition of the community is diverse. It includes thermophilic and mesothermal oak species, but also mesophilic species of beech forests. Based on the floristic composition and environmental conditions, the following two sub-associations were determined – *typicum* and *caricetosum pilosae*. In the spectrum of floral elements, plants of the Central European range type are most commonly represented, amounting to 40%. The study of the plant life forms shows that phanerophytes are the dominant class with 41%, followed by hemicryptophytes (28%). According to the indicator values of plants, the community of beech and sessile oak is mesophilic in terms of humidity, neutrophilic-basophilic in terms of acidity, mesotrophic in terms of soil nitrogen supply, sciophilic-semisciophilic regarding light, and mesothermal-thermophilic in terms of heat. Given that a large part of Kosmaj has been declared a landscape of outstanding features with significant natural, bio-ecological, and aesthetic values, research of vegetation can serve as a reliable guideline in the management of this protected area aimed at preserving and improving its biological diversity.

Keywords: *Kosmaj, beech-sessile oak forests, spectrum of floral elements, plant life forms, Serbia.*

ANALYSIS OF SUMMER AIR TEMPERATURE REGIME IN SPRUCE FORESTS IN THE KOPAONIK NATIONAL PARK, SERBIA

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Abstract

This paper presents the results of the analysis of the summer air temperature regime in the spruce forest in the Kopaonik National Park, as well as the results of the comparative analysis of the summer temperature conditions in the spruce forest and in the open space. A comparative analysis of average, minimum and maximum temperatures during the summer season (June, July and August) in the period 2012-2018 for two weather stations in the Kopaonik National Park was performed: automatic weather station in a spruce stand (ICP Forests - International Cooperative Programme on Forest Condition Monitoring in Europe - Level II sample plot) and the main weather station Kopaonik located in the open space. The average temperatures in all summer months were lower in the spruce forest compared to the average temperatures in the open space. The average summer temperature in the spruce forest was 13.0°C and compared to the open space it was lower by 0.4°C. The average minimum and maximum temperatures in all summer months were also significantly lower in the spruce forest compared to the open space. The average minimum summer temperature in spruce forest was 8.5°C and it was lower by 0.6°C compared to the average minimum summer temperature in the open space. The average maximum summer temperature in spruce forest was 17.5°C and it was lower by 0.6°C compared to the average maximum summer temperature in the open space. The obtained results indicate that in spruce forest temperatures are lower during summer, as well as that the stand canopy has the potential to mitigate summer temperature extremes.

Keywords: *air temperature, summer, spruce forests, Kopaonik, Serbia.*

GENETIC DIVERSITY OF NORWAY SPRUCE (*Picea abies* (L.) Karst.) IN NATIONAL PARK TARA (SERBIA)

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Abstract

The results of genetic variability analysis of natural Norway spruce (*Picea abies* (L.) Karst.) population located in the National park Tara in western Serbia obtained using SSR (Simple Sequence Repeat) markers have been shown in this paper. The use of microsatellite markers become tool of choice for population studies in the genetic characterization of different tree species. The genomic DNA has been isolated from needles tissue of 30 mature individuals. Out of 11 SSR primer sets markers eight (72.7%) were successfully amplified clear reproducible and polymorphic alleles among analyzed individuals of Norway spruce population. Total number of alleles revealed for all analyzed individuals were 57, with the average number of alleles 7.1 per locus. The number of alleles obtained with different SSR primers varied from eleven (EAC1F04) to five (WS0092.M15). Genetic similarities were calculated in NTSYSpc2.1 program package by Dice's coefficient. Relatively high genetic variation was observed among individual genotypes of population, as genetic distances were in range from 0.15 to 0.55. Illustration of genetic structure of natural Norway spruce population was obtained using the selected SSR markers. The necessary measures for the conservation of genetic resources in the studied population and adoption of management and renewal plans can be recommended based on the obtained results.

Key words: *Picea abies* (L.) Karst., SSR, population, variability.

EFFECT OF ACORN SIZE ON CONTENT OF PHOTOSYNTHETIC PIGMENTS IN LEAVES OF ONE-YEAR-OLD NORTHERN RED OAK (*Quercus rubra* L.) SEEDLINGS

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Abstract

The research objective was to examine effect of acorn size on content of photosynthetic pigments in leaves of one-year-old Northern red oak (*Quercus rubra* L.) seedlings. The seedlings have been produced from acorns which have been classified in three groups according to size. The content of the following photosynthetic pigments was examined: chlorophyll a, chlorophyll b and carotenoids. Leaf sampling was carried out in the mid-vegetation. The highest average value of chlorophyll a (0.639 mg/g) was determined in seedlings produced from the smallest acorns (group 1), and the lowest (0.544 mg/g) in seedlings produced from the largest acorns (group 3). The highest average values of chlorophyll b (0.465 mg/g) and carotenoids (0.510 mg/g) were determined in seedlings produced from medium-sized acorns (group 2). The lowest average values of chlorophyll b (0.369 mg/g) and carotenoids (0.188 mg/g) were determined in seedlings produced from the largest acorns (group 3). The strongest dependence was determined between carotenoids and chlorophyll b ($R^2=0.9434$) and the weakest between carotenoids and chlorophyll a ($R^2=0.0003$). The studies have shown that the content of photosynthetic pigments in leaves of one-year-old Northern red oak varies depending on the size of acorns used for seedling production. Based on the obtained results, it can be concluded that during the selection of mother trees for the reproductive material production, attention should be paid to the size of acorns, and consequently the intensity of photosynthesis, which will later have a significant impact on seedling growth elements.

Key words: *Northern red oak, photosynthetic pigments, acorn, one-year-old seedlings.*

EXTREME TEMPERATURE EVENTS IN AUGUST IN *FRAINETTO QUERCETUM CERRIS* FORESTS IN SERBIA

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Abstract

In Serbia climate zones vegetation types are represented by typical association of *Quercetum frainetto-cerrison* cambisol. The paper will show data of extreme temperature conditions in this forests for past period of 10 years in August (2010-2019). In past period (2010-2019) the maximum monthly temperature (average on monthly level 23,7 to 31,1°C) in August was increased according to equation $1.2026x - 2396.4$ with standard deviation (2,9 to 5,9°C) according to equation $y = 0.2142x - 427.71$. In this typical association in past period we found increasing coefficient of variation (10,75 to 19,67%) according to equation $y = 0.782x - 1561.7$. In past period (2010-2019) the minimum monthly temperature (average on monthly level 15,3 to 19,7°C) in August was increased according to equation $y = 0.749x - 1492$ with standard deviation (1,8 to 3,4°C) according to equation $y = 0.1146x - 228.38$. In this typical association in past period we found increasing coefficient of variation (10,35 to 18,84%) according to equation $y = 0.679x - 1354$. Based on this data we have trend of increasing of maximum and minimum of temperature in typical association of *Quercetum frainetto-cerris* on cambisol.

Key words: *Quercus frainetto*, *Quercus cerris*, extreme events.

Acknowledgments: This study is financed by Ministry of Education and Science of Republic Serbia.

POTENTIAL CONSTRAINT OF RAINFALL AVAILABILITY ON THE ESTABLISHMENT AND EXPANSION OF AGROFORESTRY IN THE MOPANI DISTRICT, LIMPOPO PROVINCE IN 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. South Africa is considered a semi – arid country vulnerable to water stress, particularly drought. Limpopo Province average annual rainfall is 600mm and the threshold for rainfall agriculture is averaged at 250mm annually. In terms of forestry, rainfall needs to be higher than 750mm per annum to sustain commercial forestry. The objective of the study was to determine the potential constraint of rainwater on the establishment and expansion of agroforestry in Mopani district, Limpopo Province. A purposive sampling technique was used to select 62 agrosilviculture community growers and were spread on the 20ha SAFCOL forestland and each grower was allocated a row of 3226m² (1ha = 10000m²; 20ha * 10000 = 200000m²/62) for production. Quantitative and qualitative designs were used. The results were based on the month the data collection started: September 2019 rainfall results indicated that there was generally good rainfall (25 - 50mm) in the agroforestry sites as compared to the agricultural open field areas. October 2019 rainfall situation improved with an increase in rainfall (51 - 100mm). During November and December 2019, increasing rainfall was experienced at 100 - 200mm and 175 - 250mm, respectively. The last three rainfall status (33rd, median & 66th percentiles) indicated the estimates of rainfall in the future years. It estimated annual rainfalls at 601 and +1000mm; +1000mm & +1000mm across 33rd, 50th & 66th percentiles, respectively. This rainfall situation is well above the Limpopo Province annual average rainfall, agriculture and forestry thresholds. Currently, the eucalyptus trees were integrated with other crops including maize, sweet potatoes, groundnuts and bambara nuts. It is thus recommended that the establishment and expansion of agroforestry be carried out in the identified suitable areas.

Key words: *Agrosilviculture System, Rainwater, Food Security, Limpopo Province and South Africa.*

ACACIA MILLEFERA (VAHL) VS MORINGA OLIFERA LAM. AS REFORESTATION OPTIONS IN BUTANA AREA, SUDAN

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Abstract

Forest rehabilitation via reforestation with and without fencing was carried out in Butana area by plantation seedlings of *Acacia millefera* and *Moringa olifera* as options. The trial was conducted at Sobagh village Central Butana (IFAD, enclosure) and EL-Adid-ELtual village Southern Butana (farmer field without fencing). Trees measurements were done for successive two years (2013-2014) during the rainy season. Measurements included: height (cm), stem diameter (mm), number of branches per plant, Survival (%). Results showed that shoot length and stem diameter increased with plant age without significant differences among tree species, However, number of branches per plant, decreased significantly in the fifth ($p < 0.04$) and seventh months ($p < 0.03$) months for *Moringa olifera*. Survival% was better for *Acacia millefera* (56%) than *Moringa olifera* (18%), since it showed steady increase with advancement of age. Generally, trees' performance was better at Sobagh enclosure than EL-Adid ELtuwal village.

Keywords: *Reforestation, Forest, Acacia millefera, Moringa olifera, Butana area.*

NATURAL AND CULTURAL LANDSCAPE MANAGEMENT IN NAHR EL KALB RIPARIAN FOREST IN LEBANON

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Abstract

Riparian forests in Lebanon are very rich in biodiversity due to the climate and topography of the country. Nahr el Kalb historical river presents riparian forests rich in natural and cultural resources and is in danger of disturbance due to uncontrolled constructions. The objective of this study is the conservation of Nahr el Kalb's riparian forest through landscape management aiming for ecotourism. The method used is site visits to identify natural and cultural resources of riparian forests: understanding locals' perceptions using the Knowledge Attitudes Practices (KAP) method, followed by a Strengths Weaknesses Opportunities Threats (SWOT) analysis and specifying potential ecotourism elements. Finally, a landscape master plan of the riparian forest with sketches explaining ecotourism activities. Results show that the steep slope of natural diversified layered vegetation, covered water channel along the river, orange trees orchards, and old bridges and buildings are potential elements for ecotourism. Locals are aware of the importance of these resources and are willing to volunteer in the management process. The conservation landscape plan presents three sustainability pillars. Ecologically, the existing covered water channel is used as a walking path after weed clearing with informative signs. Socially and economically, transformation is needed of the old buildings into guesthouses and forest-related museums with the preparation of an annual festival during orange season where eco-tourists can participate in orange picking and buy local products. In order to conserve natural and cultural riparian forest resources in Lebanon, ecotourism should be used in the landscape management plan of these forests.

Keywords: *riparian forest, ecotourism, landscape management, natural and cultural resources, Lebanon.*

EVALUATION OF FOREST LOGGING RESIDUES AVAILABILITY FOR ENERGY GENERATION: A MULTICRITERIA GEOGRAPHIC INFORMATION SYSTEM (GIS) APPROACH

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Abstract

In the context of the current climate change, energy (heat and/or electricity) generation represents an interesting solution to exploit forest logging residues, since the combustion of wood does not cause – compared to fossil fuels – additional carbon dioxide (CO₂) emissions into the atmosphere. In Italy, the quantification of harvestable logging residues for energy purposes is one of the main problems in planning forest-wood-energy chain since Forest Management Plans (FMP) generally provide information only about the harvested gross cormometric volume. Moreover, studies on this topic are generally performed at the District/Regional level, without considering site-specific primary data collected in the FMPs. The aim of this work is to quantify the mass of harvestable logging residues (m_{HR} ; $t \cdot ha^{-1} \cdot yr^{-1}$ dry matter, DM) for energy generation at the forest stand level. m_{HR} is computed by applying to the mass of producible logging residues (m_{PR} ; $t \cdot ha^{-1} \cdot yr^{-1}$ DM) a “Stand Utilization Index” (U_i ; -), which is calculated through a multicriteria Geographic Information System (GIS) approach, by combining information provided by FMPs (forest function, form of management, forest typology) with information on: (i) landscape topography (stand accessibility, forest road conditions), (ii) harvesting method and (iii) wood market demand. A first application of this approach concerned 2019 forest stands ($3.7 \cdot 10^4$ ha) of Valle Camonica District (Northern Italy) recorded in 45 FMPs. Assuming that m_{HR} is prepared into woodchips to feed cogeneration plants, heat and electricity ($GJ \cdot yr^{-1}$), as well as avoidable fossil fuels and CO₂ emissions into the atmosphere due to the contribution of each stand are also computed.

Keywords: *Energy conversion, Geographic Information System, forest-wood-energy chain, logging residues, forest stand.*

ENGLISH OAK (*QUERCUS ROBUR*) BACTERIAL ENDOPHYTES AND THEIR EFFECT ON EUROPEAN ASPEN (*POPULUS TREMULA*) MICROSHOOTS *IN VITRO*

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Abstract

Endophyte-plant relationships are still poorly understood, however it is believed that microbial symbionts use their hosts for nutrient supply, as a protective measure from environmental stress and for transmission. In return, they can have influence over plant stress tolerance, pathogen and pest resistance, growth. Endophytes achieve this by producing plant growth regulators, antioxidants, antibiotics, fungicides, insecticides, etc. Thus they can potentially be used as biofertilizers and biocontrol agents. There is a lack of research concerning the bacterial endophyte diversity of *Quercus* genus. The genus is distributed extremely widely, thus oaks have a huge ecological and economical importance. It has been shown that oak endophytic bacteria can potentially be used as biocontrol agents against known oak pathogens. The aim of this study was to isolate cultivable *Q. robur* endophytic bacteria, identify them via 16S rRNA gene analysis, colony morphology and biochemical tests as well as investigate their effects on the *in vitro* growth parameters of a model organism, *P. tremula*. Eighteen different bacterial isolates were obtained from oak using surface sterilization method: 3 *Paenibacillus* spp. isolates, 3 *Pantoea* spp. isolates and 12 *Pseudomonas* spp. Based on their test results, four different isolates were used for *Populus* microshoot inoculation: *Paenibacillus* sp., *Pantoea* sp. and two different *Pseudomonas* sp. isolates. Results showed that different inoculants had varied effects on *Populus* microshoot length and number, root length and number as well as leaf width, indicating that selected strains could potentially be used to improve plant growth *in vitro* or be used for future experiments *ex vitro*.

Keywords: *endophytes, Paenibacillus, Pantoea, Pseudomonas, Populus.*

A SYMBIOTIC BACTERIUM FROM HYBRID ASPEN IN VITRO CULTURE PROMOTES EX VITRO ADAPTATION IN OTHER POPULUS SPECIES

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Abstract

Although plant micropropagation via *in vitro* culture is usually a microbe-free method, some specific plant-associated bacteria can survive disinfection and continue to live in plant tissue culture. The present study reports a potential of such symbionts to promote growth processes even in non-host plant species. The studied bacterium was isolated from the tissue culture of hybrid aspen (*Populus tremuloides* × *P. tremula*) and classified as *Paenibacillus* sp. by 16S rRNA gene analysis. In order to test its effects on a non-host *Populus* species – Berlin poplar (*Populus* × *berolinensis*), this bacterium was either inoculated *in vitro* on the nutrient medium for the otherwise bacterium-free poplar explants or, in the form of freeze-dried powder, mixed into water and applied to the *in vitro*-collected poplar shoots before their adaptation *ex vitro*. Although, in the first case, the initial *in vitro* effect of *Paenibacillus* sp. on poplar explants was negative (lower shoot length and impaired root system development), it still turned to be positive during *ex vitro* adaptation: at the end of the adaptation period, the shoots from the bacterium-treated variant had 71% higher average root length and 118% higher shoot mass than the non-treated control. In the second case, the poplar shoots treated with freeze-dried *Paenibacillus* sp. before the start of *ex vitro* adaptation, finally had 62% higher average root number and 68% higher root mass, in comparison to the control. Thus, the *Paennibacillus* sp, bacterium was confirmed as a helpful tool to obtain stronger poplar plants after the whole micropropagation process.

Keywords: *Paenibacillus*, *Poplar*, *In vitro*, *Micropropagation*, *Ex vitro adaptation*.

TYPES OF FORESTS AND TYPOLOGICAL BASIS OF FORESTS IN MULTIFUNCTIONAL PLANNING AND FUNCTIONAL SUSTAINABILITY OF THE ENVIRONMENT

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Abstract

The basis of the typological study of forests is based on the study of forests as a complex biogeocenosis, variable in space and time. This implies division and making of a classification on a basis that such parts represent separate and recognisable wholes arising from the biogeocenotic study and classification, which relates to the ecological-coenological segment of the forest and, potentially-productional segment and aspect of forest and forest as a whole. In this sense, natural forest ecosystems are formed, established and classified in relation to the studied characteristics - as forest types. The methodology itself, and in that sense the methodological approach, provides the starting point in planning orientation and planning, which are related to different and multifunctional approach and preservation of natural ecosystems, natural sustainability and functional sustainability of natural ecosystems and environmental protection as a whole, multifunctional forest functions in the overall environmental sustainability. It is especially important to establish a link between forest classification, in that sense - forest types, and prominent functional requirements in planning, provision and optimisation of a specific forest function, for example, establishing a link between the typological basis in functional forest planning and their planning orientation when it comes to the specific function of forests. In particular, the anti-immission function of forests is expressed through biologically functional requirements and other bio-technical and specific requirements that specifically relate to the biogeocenotic approach to the study of forests and on that basis its classification into forest types. The basic starting point and structural orientation of this research is to consider the possibility of improving the overall potential of forests and their multifunctional sustainability in multi-purpose planning and functional sustainability, environmental protection and especially the relationship of primary structure of forest types to climate change in that sense, through biological, biotechnical, technical and other specific requirements in order to create a functional optimum of a specific forest and planned zoning in specific conditions and wider social needs.

Keywords: *forest type, typological basis, forest functions, functional requirements, planned zoning.*

THE INFLUENCE OF THE GLOBAL CLIMATE CHANGE ON FORESTRY

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Abstract

Under the influence of energy exchange disturbances between space and the Earth, and the increase of greenhouse gases and thus accelerated global warming, climate changes out of its usual natural variability have been caused. The consequences of the speed of current climate change are the frequency and increase of extreme events (droughts, floods, fires, etc.). Mankind is fighting this problem by applying measures for ensuring sustainable development and preservation of the natural environment. Forest ecosystems are particularly sensitive to climate change due to their low speed of change and adaptation ("passive adaptation") to the increasingly pronounced xerothermization of the climate. At the same time, extremely hot and dry weather conditions are the cause of high sensitivity of vegetation: displacement of distribution zones of some species of plants and animals towards the north and higher altitudes, reduction of biodiversity, reduction of plant vitality, dieback and extinction of some species, etc. The risks arising from the negative effects of climate change are reflected in the financial losses due to the reduction of the quantity and quality of wood mass in forestry, as well as the degradation of the environment and normal functioning of the biosphere. Therefore, forestry, along with agriculture, water regime and the environment in general, is considered one of the key vulnerable sectors. Applying appropriate measures in the preservation and maintenance of forest ecosystems is necessary and urgent and requires long-term planning, based on a more reliable and precise definition of future climate change. One of the key measures for adaptation, which requires long-term planning and is very sensitive to the reliability of vulnerability assessment in the conditions of changing climate is: selection of tree species and their varieties with greater tolerance to changed climate conditions, but also adaptability to optional climatic conditions and forest management approach with the aim of mitigating climate change ("active adaptation").

Keywords: *Climate change, Forestry, Vulnerability, Adaptation.*

***PSEUDOTSUGA MENZIESII* (MIRB.) FRANCO IN THE NW OF IBERIAN PENINSULA: SITE QUALITY AND FORESTRY**

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Abstract

Pseudotsuga menziesii (Mirb.) Franco, Douglas-fir, is a conifer of the *Pinaceae* family. The Oregon pine name, used to refer to both the tree and its wood, can take to confusion, because its needle-like leaves are not sheathed. It can reach up to 100 meters height in the country of origin –discovered by Menzies in Vancouver in 1792–, existing in Europe trees of 50 m. The cup is conical and pointed, and it needs a long time to crown, which indicates a great capacity to maintain continued growth. The first plantations in Spain were ornamental, and in Galicia large specimens dating from the nineteenth century have been conserved. Its use during the repopulation period of the Forest Heritage was scarce, especially in the NW of Iberian Peninsula, where the oldest stands are not older than 40 years. In other Spanish regions, Forest Administration used this species more amply. According to the latest data, an area greater than 30,000 ha is estimated. Douglas-fir grows on a wide climatic range, from oceanic to continental, with uniform distribution of rainfall. Optimal conditions for increased production are a wet oceanic climate with 2-3 months of drought. Oregon pine is a fairly demanding tree in edaphic conditions, preferring deep soils with a light texture and fertile. It is a species capable of producing high quality wood and forest treatments should be directed for this. It will be basic to prune so wood is formed free of knots and to eliminate unnecessary branches. In Galicia the maximum production range would go from 14 to 23 m³ha⁻¹year⁻¹.

Keywords: *Pinaceae*, *Douglas-fir*, *Site*, *Forestry*.

***PSEUDOTSUGA MENZIESII* (MIRB.) FRANCO IN THE NORTHWESTERN OF THE SPAIN: WOOD PROPERTIES, PRODUCTION AND FINAL CUT**

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Abstract

The Oregon pine wood is of excellent quality and it is imported from North America. Afforestation by this species carried out in northern Spain, Galicia, Asturias and other regions; in many European countries is considered very important because it produce wood of equal or superior quality to the imported one. Oregon pine has slightly orange heartwood and clear sapwood. The growth rings are particularly visible, and with a proper forestry are very regular. Their density is higher than in most conifers of commercial interest, 0.48 gr.cm^{-3} . The wood has excellent technological qualities, even when the tree has grown quickly. Its major defect is the presence of knots, which are usually alive and so healthy. Pruning is essential to allow the tree development. The wood production that could be obtained depends on the site quality, the material and the repopulation techniques, and the cultural treatments. The French production tables of the Massif Central consider 3 quality classes with maximum production ranging from 15 to 23 $\text{m}^3\text{ha}^{-1}\text{year}^{-1}$. In Galicia and Asturias, growth studies have been carried out to compare with these tables, obtaining the following results: i) in the repopulations carried out in abandoned agricultural lands and with intensive cultural cares in Galicia, the quality far exceeds the best French and the production, if the density –number of trees per hectare– is high, reaches great values; the maximum production would be between 14 and 23 $\text{m}^3\text{ha}^{-1}\text{year}^{-1}$; ii) the researches carried out in Asturias show lower results due to that most of the stands of a certain age be correspond to forests repopulated by the Administration on poor quality soils. In any case, the production would be between 12.5 and 21.4 $\text{m}^3\text{ha}^{-1}\text{year}^{-1}$.

Keywords: *Pinaceae, Oregon pine, Wood features, Growth, Rotation.*

PRACTICE OF TRADITIONAL CROP PRODUCTION IN THE NATURAL FORESTS OF DRYLAND OF SUDAN IMPROVED THEIR NATURAL REGENERATION

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Abstract

The survival of natural forests in Sudan is facing a great challenge due to the conflict to secure food for ever increasing population on the account of their diminishing stocked areas and the efforts to manage them to sustain their environmental and economic values and services that are hardly considered by the politician and strategic planners. Each argument is striving to scrub out the other without providing evidence denying the achievement of both simultaneously. Therefore, this study investigated the effect of traditional cropping practices by the local farmers inside the natural forests on their natural regeneration stocking density and performance. The natural regeneration was systematically sampled in four compartments in natural forests of *Acacia seyal*. One was left uncultivated after felling and the other three were cultivated for consecutive two, three or four years. Inventory of natural regeneration was carried out accordingly. Significant regeneration was found surviving on all compartments but it was denser where it succeeded cultivation. It was 750 seedlings ha⁻¹ in uncultivated compartment and 1000 – 4000 seedlings ha⁻¹ in cultivated ones. Moreover, the regeneration was vigorous and taller following the cultivation. The results underlined the oversight understanding of the negative impact of cropping on regeneration of natural forests and favored its integration in the restocking programs. This could solve the conflict on land and encourage the participation of the local communities in the management of forests as well as contributing in food security.

Keywords: *Acacia seyal, traditional cropping, practices, regeneration, integration.*

GUAVA VALUE CHAIN IN ZIMBABWE: A PARTICIPATORY SURVEY ON BOTTLENECKS AND OPPORTUNITIES

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Abstract

Guava production has the potential to increase livelihoods of farmers and rural areas of Zimbabwe (70%) and create employment in the value chain. Increasing the production of guavas in Zimbabwe will increase their consumption, benefit the health of many people and increase incomes of smallholder farmers and poor people involved in the supply chain. There are few research activities to realize the full potential of guava and guava related products. This participatory study aims to evaluate the potential to commercialize Zimbabwe red and white guava varieties by analyzing the value chain from production, processing, marketing and exportation. Household surveys were conducted in October 2019-March 2020 to assess the bottlenecks and opportunities in Zimbabwe's five provinces by gathering information on mapping areas with production, client demand, role of private sector, the government, education institutions and the public sector in Zimbabwe on the unique competitive advantage of Zimbabwe on guava production, growing seasons, production methods, storage and packaging methods and the key certificates in relation to guava production. Results showed that most fresh guava fruits were eaten raw (90%) and there was little processing from local guava resources. Most guava products like guava juice was imported from South Africa (80%). On the other hand, the most grown areas were in Natural Regions 1,2 and 4 with high (800-1000mm) medium (400-800mm) and low (<250mm/year) rainfall, respectively. Globally, Zimbabwe is ranked 77th with shares of 0.0% in guava production, market shares in global exports of 0.0% and market Shares in global imports 0.0%.

Keywords: *Guava, Bottlenecks, Livelihoods, Mapping, Zimbabwe.*

AN ATTEMPT TO VALORIZE FOREST HABITATS USING THE ZOOINDICATION METHOD ON THE BASIS OF BEETLES CAUGHT ON DEAD PINE TRUNKS

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Abstract

The currently used zoindication methods are used to assess the condition and functioning of forest ecosystems. The role of zooinicators is played by beetles associated with the studied features of the environment and specific environmental conditions. Arboreal beetles are one of the most used zooinicators. The group of beetles most widely used in the valorization of the naturalness level of the forest environment is those associated with dead wood. In the habitat valuation procedure, the results of catching beetles found on dead pines were used. Scots pine (*Pinus silvestris* L.) is the main forest-forming species of boreal forests in the temperate climate zone. The habitats most frequently found in boreal forests were selected for the valorization of the naturalness of the habitats. The poster presents a comparative analysis of the conservation values of dead pine trees growing on a variety of forest habitats. Adjustment was made on the basis of participation in the clusters of beetle species associated with die away trees and dead wood as well as rare and relict species. The basis for the analysis was the faunal material collected on the surface of the trunks of dead trees by type of trap Geo-Forest. The analysis uses the results obtained in the valorization of natural forest habitats Świętokrzyskie Mountains and Forests PFC Spalsko-Rogowskie. A total of 53 traps were placed on pine trunks. Humidity gradient of habitats clearly differentiates the value of arboreal assemblages of beetles infesting dead pine trunks, showing a higher environmental value in the case of pines growing in moist habitats variants. Dead pines growing in moist and wet habitats constitute micro-environments for numerous rare and important species for biodiversity.

Key words: *zoindication, zooinicators, forest habitats, forest ecosystems.*

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