FROM HIDDEN THREATS TO INNOVATIVE ASSETS
TRANSFORMATIVE CAPACITY OF AGRIFOOD SYSTEMS

Transformative actions to turn threats into assets in the face of global challenges

BOOK OF ABSTRACTS

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Content

GREENING AGRICULTURAL PRACTICES: ADVANCEMENTS IN SUSTAINABLE PLANT PRODUCTION

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GREENING AGRICULTURAL PRACTICES: ADVANCEMENTS IN SUSTAINABLE PLANT PRODUCTION

THE ROLE OF PLANTS IN DIFFERENT ASPECTS OF HUMAN LIFE WITH FOCUS ON MENTAL HEALTH

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Summary

Urbanization leads to the exploitation and occupation of green areas, contributing to a high degree of their fragmentation. In this way, the habitats of plants and animals are endangered, which has a very negative effect on biodiversity within cities. These consequences of urbanization require innovative concepts of urban design that will increase the quality of life in urban areas.
This paper presents ways of introducing plants into cities, and presents their importance in improving the quality of life in urban areas. Given that there is a higher percentage of mental health problems in cities than in rural areas, special emphasis is placed on the role of green areas and plants indoors in improving the mental state of people, and in preserving their mental health. The results of numerous research that contribute to the understanding of the effect of plants on the quality of life in urban areas are given.

Keywords: *urbanization, fragmentation of green areas, quality of life, mental state, mental health.*

SIMULATING MAIZE CROP PRODUCTIVITY AND IRRIGATION REQUIREMENTS IN THE BANJA LUKA REGION

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Summary

The aim of this study is to characterize the crop productivity of rainfed maize corresponding to the traditional crop production system, during the baseline period (1971-2000) in Banja Luka. Climate change is expected to increase water scarcity, so irrigation water requirements for maize are also being assessed.

After proper calibration, the AquaCrop-OSPy model was used to simulate net irrigation requirements (NIR) and yield. Input data includes agronomic data related to the maize variety FAO400, grown in 2021-2023 seasons and grown at the Aleksandrovac Experimental Station within the SMARTWATER project. The E-OBS gridded climate data, were used after bias correction using the Banja Luka weather station.

Results show a shortening of crop cycles due to increasing average temperatures during the study period. Under rainfed conditions, maize yields averaged 9.3, 8.9, and 8.5 t/ha for early, normal, and late sowing dates, respectively, with the lowest yields recorded in 1988 due to significant drought. The highest yields were observed in 1997, when July precipitation increased by 54% compared to the average.

For supplemented irrigated maize, NIR at the normal sowing date averaged 176 mm. Under severe drought conditions, NIR increased to 236 mm and, under extreme drought, it reached 253 mm. Irrigated maize yields were 10.7, 10.5, and 10.2 t/ha for early, normal, and late sowing dates, respectively. Early sowing resulted in slightly higher yields due to the longer growth cycle, with 1972 being the least productive year across all sowing dates due to excessive precipitation and reduced evapotranspiration.

Keywords: *Irrigation; Yield; Climate change; E-OBS; modelling*

MOSAIC OF THE AGRICULTURAL LANDSCAPE OF THE SLAVON PLAINS - STRUCTURE CHANGES AND THE INFLUENCE OF CLIMATE CHANGES

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Summary

Today, the effects of climate change are being recorded more and more, which are manifested by a longer period of drought, the absence of snow cover, sudden precipitation and floods, torrents that cause soil washing and landslides, earthquakes and the appearance of diseases and pests. Agriculture is oriented towards new technologies of tillage, land reclamation, irrigation and selection of new crops. In parallel with these changes, Croatia is turning to organic production, which becomes extremely fragile under such conditions. The landscape values are changing, and thus the shape of the mosaic of fields of the Slavonic plain, which are losing their basic features, namely the corridors of streams, rivers, canals and ponds, patches of forest and edges of fields in the shape of a nerve, which preserve biodiversity and are the basic shape features historical matrices of agricultural areas of Slavonia.

In this paper, the historical matrices of the development of agriculture in Slavonia are presented, the changes that occurred and the plant species of field hedges are recorded, the importance of oak forests, as well as the importance of lakes, the establishment of systematic irrigation, and the economic losses caused by climate change are highlighted.

Keywords: *field matrix, Slavonia, climate change, hedges*

GENETIC RELATIONSHIPS AND DIVERSITY OF COMMON BEAN VARIETIES IN BOSNIA AND HERZEGOVINA

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Summary

Common bean (*Phaseolus vulgaris* L.) has been cultivated for centuries in Bosnia and Herzegovina, playing a significant role in traditional agriculture. Common bean varieties' diversity includes regionally bred cultivars and landraces grown on a smaller scale. This study analyzed 21 common bean varieties preserved at the Gene Bank of the Faculty of Agriculture and Food Sciences in Sarajevo to assess their genetic diversity and relationships using 26 SSR (Simple Sequence Repeat) molecular markers. The research aimed to identify distinct landraces and to compare their genetic profiles with the most commonly grown cultivars in the region. Factorial Correspondence Analysis (FCA) and Analysis of Molecular Variance (AMOVA) revealed that several accessions represent genetically distinct landraces that significantly differ from the most popular varieties. This study provides valuable insights into the genetic diversity of common beans in Bosnia and Herzegovina, contributing to their conservation and utilization in crop improvement efforts.

Keywords: *Common bean varieties, Genetic diversity, SSR markers, Genetic relationships, Analysis of Molecular Variance (AMOVA)*

CHALLENGES AND INNOVATIVE APPROACHES FOR WATER USE IN IRRIGATED AGRICULTURE

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Summary

In recent years, global warming and climate change have become the most important natural and/or human-induced environmental issues on Earth. Accordingly, the most affected sector is agriculture with a particularly negative impact on water resources. By 2080, it is estimated that a 20% increase in water demand will lead to a 10% decrease in agricultural production. Irrigated agriculture is mostly practiced in Asian countries and water is used much more in agriculture in the same countries. The water used in agriculture in the world varies from 40% to as high as 92% depending on the country. Irrigation efficiencies also vary from 35% to 70-80% depending on the country. On the one hand, there are the overuse of water and also major environmental challenges such as salinization and erosion. Thus, efficient and sustainable use of water has become imperative for both climate change and increasing population and food security. This will be possible with the use of new innovative approaches, technological methods and devices to save water and increase water productivity in agriculture. However, many factors such as education of water users, social, cultural and political conjuncture have an impact on water use. On the other hand, the economic productivity of agricultural irrigation also varies in a wide range from 0.10 USD to 2.20 USD per m^3 of irrigation water. These data show us that it is still necessary and even obligatory to increase irrigation efficiency and to use irrigation water more economically where water is used intensively or excessively in agriculture in the world. In this presentation, agricultural water use in different countries around the world, comparisons of water productivity, challenges and, consequently, innovative approaches to water use in agriculture are discussed in terms of food security and water productivity perspectives.

Keywords: *Agriculture climate change, food security, innovative approaches, water productivity*

BEGONIA (*BEGONIA SEMPERFLORENS* HOOK.): THE POTENTIAL VALUE IN THE PHYTOEXTRACTION OF THE CHROMIUM, LEAD AND CADMIUM

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Summary

Lead (Pb), cadmium (Cd), and chromium (Cr) are pollutants that have toxic effects on human health. Their concentrations in soil have risen sharply in recent decades due to industrialization and urbanization, causing growing concern in modern societies worldwide. In this regard, it is of utmost importance to take appropriate remediation measures to reduce soil contamination by Pb, Cd, and Cr. Phytoextraction uses the ability of some plants to take up pollutants, mainly heavy metals, from a contaminated area and transfer them to harvestable above-ground biomass. It is an efficient, environmentally friendly technique that does not require any special equipment for implementation and therefore could be an effective strategy to remediate heavy metal polluted soils cost-effectively. Begonia (*Begonia semperflorens* Hook.) served as a candidate species for phytoextraction of Pb, Cd, and Cr in this study. The pot test was performed under greenhouse conditions in a completely randomized design for each analysed heavy metal. It included four contamination treatments (0, 20, 50, and 100 mg kg^{-1} for Cd, and 0, 100, 250, and 500 mg kg^{-1} for Pb and Cr). Pb, Cd, and Cr contents in plant and substrate samples were determined by atomic absorption spectroscopy. The phytoextraction potential of begonia was estimated by bioaccumulation (BAF) and translocation (TF) factors analysis. BAF values of both Cr and Pb were less than 1 regardless of contamination levels, indicating that this species has limited capacity to restore soils contaminated with these metals. The BAF values of Cd were higher than 1 at all contamination levels, implying that begonia plants have the potential to remove Cd from polluted soils. However, the above should be considered with caution because the dry matter percentage in the aerial parts of begonia plants is low (below 3% in this study), which is undesirable from the phytoextraction point of view.

Keywords: *bioaccumulation, heavy metals, phytoremediation, soil*

AVAILABILITY OF AGRICULTURAL TRACTORS IN BOSNIA AND HERZEGOVINA AND TECHNICAL ASSESSMENT OF FARMERS PURCHASING POWER

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Summary

The tractor is a key driving unit in modern agricultural production. Today, the focus is on reducing production time, lowering costs, and automating human labor through the use of various tools and machines. Modern tractors enable faster, better, and more efficient execution of agro-technical operations. This study explores the possibilities and capabilities of farmers in Bosnia and Herzegovina compared to other CEFTA members in purchasing an adequate, quality, and suitable new tractor. The research analyzes the process of trade liberalization in Southeast Europe, including the Agreement on Amendment and Accession to CEFTA. The study covers an analysis of ten global tractor brands across 110 different models. The average tractor prices and prices per kW of power were calculated by brand, and a categorization (according to the AHP method) into three groups: A, B, and C was performed. The research results showed that New Holland brand tractors are the most expensive, while Foton brand tractors are the cheapest. In terms of price per kW, Ferrari brand tractors are the most expensive, while ArmaTrak brand tractors are the cheapest. Differences in the purchasing power of farmers in Bosnia and Herzegovina compared to CEFTA members were also analyzed, with a focus on differences in average salary. Serbia has the highest average salary among CEFTA members, while Moldova has the lowest. The purchasing power of farmers was determined by calculating the purchasing ability coefficient (MK), which showed that farmers from the Republic of Serbia and farmers from Montenegro have the highest purchasing power for all examined tractor brands, while Moldova is the weakest by this indicator, and theoretically, farmers do not have the ability to purchase tractors of any examined brand. Farmers from Bosnia and Herzegovina do not have the purchasing power to buy Kubota and Ferrari brand tractors but have the purchasing power to purchase Foton, ArmaTrak, and Case brand tractors.

Keywords: *tractor, brand, CEFTA, purchasing power, farmer.*

EFFECT OF MULTIFUNCTIONAL PYROPHYLLITE FERTILIZER ON THE GROWTH, YIELD AND ESSENTIAL OIL CONTENT OF *MENTHA PIPERITA*

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Summary

The purpose of this study was to examine the effects of multifunctional pyrophyllite fertilizer (MPF) on the biomass production, yield and chemical composition of peppermint *(Mentha piperita* L.) essential oil. This ecological MPF, which improving soil properties, slowing nutrient release, and enhancing plant nutrient uptake efficiency, is composed of pyrophyllite and dolomite from the Parsovići, Konjic, BiH. The sum of secondary macronutrients (CaO and MgO) contained in MPF is higher than 18% which confirms that this product fulfilled the requirements of EU Regulation 2019/1009. A field experiment was conducted in Banja, Aranđelovac, Serbia with two types of fertilization (control: NPK 15:15:15 30 g/m2, plant residue compost 5 kg/m2 and experimental: NPK 15:15:15 30 g/m2 plant residue compost 5 kg/m2 with 500 g/m2 MPF addition). At the end of the experiment growth parameters (average plant height, fresh herb and leaf weight) were measured. MPF treatment increased growth parameters by 13.16 %, 7.63 %, 16.07% respectively compared to the control. Essential oil samples were obtained by hydrodistillation, analyzed using GC/MS, and the chemical composition of each peppermint oil sample were determined. Differences in the chemical composition of the essential oil were observed for only four components (trans-sabinene hydrate, α-cadinol germacrene D and bycyclogermacrene) found in MPF treated samples without significant changes in the main constituent content. Based on the experimental results it is recommended to treat Mentha piperita L. plants with MPF to obtain higher biomass production and preserve essential oil yield and chemical composition.

Keywords: *pyrophyllite Parsovići, fertilizer, Mentha piperita L., GC/MS, essential oil*

DEGREE OF FREEZING AND FERTILITY OF WINTER BUDS OF MALVASIA ISTRIANA AND GARGANEGA VINE VARIETIES IN THE ŽEPČE AREA

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Summary

The aim of this research was to examine the degree of freezing and the fertility of winter shoots along the shoots of the Malvazija Istrian and Garganega vine varieties grown in the Žepče area. The vine is sensitive to low winter temperatures, and the degree of freezing of the winter buds and other organs depends on the biological characteristics of the variety and the ecological conditions of cultivation. The degree of freezing of winter buds was determined by the method of provocation of buds, while the fertility of shoots was determined by counting inflorescences per bud, shoot and reproductive shoot. Samples were taken at the beginning of March, 10 shoots with 10 buds for each variety. Fertility and the degree of freezing of winter buds along the length of the shoots were monitored. Based on the obtained results, the percentages of buds, fertility coefficients of buds and shoots, and the fertility of varieties, as well as the fertility of developed buds from the first to the tenth nodus on the shoot, were calculated. By analyzing the measured parameters, we can conclude that the tested varieties can be successfully grown in the ecological conditions of Žepče, and the values of all tested parameters were higher in the Malvazija Istrian variety compared to the Garganega variety.

Keywords: *Malvasia Istriana, Garganega, buds, fertility, freezing.*

axiomFP.py: AN OPEN-SOURCE TOOL FOR ANALYZING PLOIDY LEVELS AND ASSESSING SNP CALL QUALITY OF AXIOM SNP ARRAY DATA

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Summary

axiomFP.py is an open-source software developed to diagnose ploidy level and call quality for samples genotyped on Affymetrix Axiom SNP arrays. The tool generates frequency plots of normalized SNP call positions based on clustering parameters, providing a visual method for ploidy determination and quality control. This research outlines the methods employed in the development of the software, and presents the results obtained through its application on a dataset of mixed ploidy apple (*Malus* spp.) cultivars and germplasm accessions. The tools for preparing input files and running the software are also outlined. The generated frequency plots require a visual inspection to assess ploidy and call quality. The results have been validated against available ploidy data and confirmed through flow cytometry, showing 100% accuracy. The software is available on GitHub at https://github.com/allmiraria/axiomFP.

Keywords: *Axiom, genotyping, frequency plots, call quality*

UVOLOGICAL CHARACTERISTICS OF THE MERLO AND VRANAC GRAPE VARIETIES DEPENDING ON THE METHOD OF PRUNING

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Summary

The aim of this work was to study the effect of pruning on the uvological characteristics of the Merlo and Vranac wine varieties in the Trebinje region. The research was carried out in 2018, each variety had two variants of pruning, and each variant had three repetitions. The load levels of buds in this study were 11 (Variant I) and 9 (Variant II) buds per vine. The most important uvological parameters of the tested varieties were measured. The variety, as an experimental factor, had a statistically significant influence on most of the investigated indicators, while pruning did not.

The research carried out in the area of Trebinje shows that both tested varieties can be successfully grown in the mentioned locality because the climatic conditions are suitable for their cultivation.

Keywords: *Merlo, Vranac, pruning, uvology*

INSECTICIDAL EFFECT OF TRACHYSPERMUM AMMI L. ESSENTIAL OIL AS A SUSTAINABLE SOLUTION FOR *DROSOPHILA SUZUKII* MANAGEMENT

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Summary

The invasive, polyphagous species *Drosophila suzukii* infests soft-skinned fruits like raspberries, blueberries and grapes. Active and passive modes of transmission, coupled with the numerous generations, have facilitated its successful invasion. Chemical insecticides are currently used to manage *D. suzukii* infestations. Due to the significant damage caused before harvest, chemical interventions leading to heightened levels of pesticide residues are not recommended. Significant research has been dedicated to exploring biological methods for pest control as an alternative to synthetic insecticides. The aim of this study was the assessment of the insecticidal effect of ajowan (*Trachyspermum ammi*) essential oils for the control of *D. suzukii* through fumigant-contact, contact, and repellent tests. To enhance understanding of its mode of action, chemical composition (GC–MS) of the ajowan oil was analyzed. All treatments were performed in 4 replications and flies aged 4-7 days were used. Three concentrations (1%, 5%, 10%) of essential oil were applied. The mortality of the flies was recorded after an exposure time of 24h, in the fumigant-contact and contact tests. The emergence of newly hatched flies was also followed in contact test. Ajowan oil caused mortality over 85% in the fumigant-contact test for concentrations of 5% and 10%, while in the contact test mortality of 90% was obtained even at the lowest concentration (1%). All three concentrations exhibited repellent properties. The dominant compounds, γ-terpinene and thymol, may exhibited a synergistic effect, enhancing the insecticidal efficacy. Essential oils demonstrate promising potential as effective control agents, offering a natural and environmentally friendly alternative.

Keywords: *D. suzukii, bioinsecticide, essential oil, ajowan*

APPLICATION OF BIOINOCULANTS IN THE FUNCTION OF OPTIMIZING AND REDUCING THE USE OF MINERAL FERTILIZERS FOR ACHIEVING A HIGHER YIELD AND QUALITY OF SILAGE MAIZE ON THE FARM KJP "PD BUTMIR"

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Summary

Maize is one of the most important crops, with significant agricultural and economic importance both globally and in Bosnia and Herzegovina. In Bosnia and Herzegovina, approximately 320,000 hectares are sown with cereals, of which 200,000 hectares are maize. Despite being the most important crop, domestic maize production only meets half of the demand, with average yields far below global standards, primarily due to insufficient fertilization. To achieve high yields and quality, it is essential to ensure optimal amounts of nitrogen (N), phosphorus (P), and potassium (K) in the soil. New technologies, such as the use of rhizobacteria like Pseudomonas and Bacillus, can reduce dependence on mineral fertilizers, especially due to phosphorus-deficient soils in Bosnia and Herzegovina. This research aims to improve maize productivity and soil fertility through the use of biological fertilizers and adequate fertilization. Experimental trials are conducted on the fields of KJP "Poljoprivredno dobro Butmir," which annually sows about 200 hectares of silage maize for feeding 400-500 dairy cows. Various fertilization methods are tested to identify the most effective techniques for improving maize production.

Keywords: *maize, fertilization, PGP bacteria*

EFFICACY OF NEW INSECTICIDES GENERATION IN CONTROLLING TOMATO LEAF MINER (*TUTA ABSOLUTA* POVOLNY)

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Summary

The tomato leaf miner (*Tuta absoluta*) is a pest that causes significant damage to tomato production in Bosnia and Herzegovina. According to previous research, the frequent use of older generation insecticides has led to increased resistance to *Tuta absoluta*. The aim of this work was to examine the efficacy of the newer insecticides generation in controlling tomato leaf miner in greenhouse production in southern Bosnia and Herzegovina. Testing the efficacy of insecticides was carried out in experimental tomato plants (hybrid *Matias*) in the localities of Višići, Gabela and Klepci during a three-year period (2012-2014). The effectiveness was tested on the following variants of insecticides: Indoxacarb, Emamectin benzoate, Methoxyfenozide, Lufenuron, Chlorantraniliprole, Azadirachtin, Spinosad and the combination of Abamectin + Lufenuron. Based on the number of live larvae in the mines, according to Abbott, the efficiency values of the applied insecticide variants were calculated. The combination of insecticides based on the active substances Abamectin and Lufenuron showed the highest percentage of efficiency. The insecticide based on the active substance Spinosad showed the lowest percentage of efficiency.

Keywords*: tuta absoluta, larvae, control, insecticides, tomato*

CHARACTERIZATION OF WASTE WATER FROM SLAUGHTERHOUSES AND OPTIMIZATION OF ITS FINAL TREATMENT

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Summary

This research work presents characterization of wastewater generated in the different stages of work in the slaughterhouses. High water consumption has a negative impact on the environment through the discharge different pollutions through the waste water, but also because of the consumption of natural resources

The intention of the research was to obtain data on wastewater characteristic, and based on these data, in accordance with the best available techniques, propose measures to improve the final treatment in a given food industry. The study was conducted in a case study slaughterhouse in Sarajevo Canton, which is diagnosed in terms of production and environmental impact using MOED methodology, and from where the samples of waste water were taken in different stages of production process. Furthermore, taken samples were analyzed by physicochemical methods, in order to obtain the required values of the parameters, then that value is compared with the legally prescribed maximum allowable concentrations.

As this work was focused on inspection of existing water consumption practices in slaughterhouses it has been confirmed that the daily wastewater in slaughterhouses comes from several technological operations: watering and washing livestock, slaughtering, cutting, meat processing, processing of secondary products (by-products) and cleaning of equipment and slaughtering and cutting lines. The amount of waste water generated in the slaughterhouse is about 8-13 m3/t of live weight. In terms of percentage, water consumption by individual stages looked like this: receiving and maintaining animals - 22%, slaughtering and bleeding animals - 28%, cutting and confectioning process - 21%, primary meat processing - 22% and hygiene and sanitation 7%. By comparing these results to water consumption indicator, that recommended for medium to large slaughterhouses, it can be concluded that the water consumption extremely high.

The aim of this research is to identify areas of low water consumption efficiency and inadequate management in the case study slaughterhouse with meat processing, and to identify the best available techniques that address the identified problem.

Keywords: *slaughterhouses, wastewater, best available techniques, treatment optimization.*

EFFECT OF STORAGE ON PHYSICAL AND CHEMICAL QUALITY PARAMETERS OF DIFFERENT APPLE CULTIVARS

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Summary

The aim of the study was to investigate the impact of normal atmosphere (NA) storage on the quality and storability of apple fruits. The experiment was conducted during 2017 and 2018 in the municipality of Gradačac. Three cultivars were studied: 'Idared', 'Golden Delicious' and 'Jonagold'. The apples were harvested at commercial maturity and analysed both before and after four-month storage period. The following physical and chemical quality parameters were analysed: weight, color, firmness, soluble solid content, individual sugars, and individual organic acids. The maximum weight loss observed was 7.84% in the 'Golden Delicious' cultivar, followed by 3.70% in 'Jonagold', while 'Idared' exhibited the least weight loss at 2.10%. The most significant colour skin changes (ΔE) during storage were noted in the ‘Golden Delicious’ cultivar. The fruit firmness, the content of total sugars and organic acids for all three cultivars significantly decreased after storage. The highest total sugars content was measured in 'Golden Delicious' cultivar, while the lowest values were measured in 'Idared' cultivar. ‘Idared’ cultivar had the highest organic acids content both before and after storage. A statistically significant decrease in the Thiault and Perlim quality index (multiparametric quality indicators) suggests poor storability of the tested apple cultivars under the analyzed conditions. The findings of this experiment suggest that reducing the storage duration of the analyzed apple cultivars under normal atmospheric conditions is beneficial.

Keywords: *apple, normal atmosphere, storage, cultivar, quality*

MORPHOLOGICAL AND POMOLOGICAL EVALUATION OF DIFFERENT CULTIVARS OF RED AND WHITE CURRANTS

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Summary

The study aim is the evaluation of morphological and pomological characteristics of several introduced currant cultivars. The research was conducted in the orchard of the Ilidža and Visoko Municipalites, in year 2020. At the Ilidža location, four currant cultivars were observed: Junifer, Rovada, Pink Champagne and Blanka, while at the Visoko location, the cultivars Junifer and Rovada were monitored. During the research, the following parameters were tracked: vegetative potential of currant cultivars (height, width, and volume of the bush); generative potential of currant cultivars (number of clusters per bush, number of berries in a cluster; cluster weight; berry weight), within the chemical characterization of the fruit (total soluble solids and total organic acid contents), fruit color using L a b color system. Spectrophotometric and HPLC analysis of phenolic components conducted on the fruits from the Ilidža location.

At the Ilidža location, the Blanka cultivar stood out in terms of bush height, width, and volume, cluster weight, as well as L*, b* H* color parameters and the phenolic content in the fruit. The Junifer and Pink Champagne cultivars stood out in terms of berry weight, soluble solids content and the a* fruit color parameter.

At the Visoko location, the Junifer cultivar had significantly higher values for the number of clusters per bush, cluster weight, and soluble solids content in the fruit compared to the Rovada cultivar. The Rovada cultivar, in comparison to Junifer, stood out in terms of the number of berries per cluster and L*, b*, H* fruit color values.

The comparative analysis of the Junifer and Rovada cultivars among the Ilidža and Visoko locations showed that the location had a significant influence on the number of berries per cluster, cluster weight, berry weight, soluble solids content, organic acid content, sweetness index, as well as on the L* a* fruit color parameters.

Keywords: *Ribes sp., cultivar, Junifer, Rovada, Pink Champagne, Blanka, location*

DETERMINATION OF SOME QUALITY PARAMETERS OF TOMATO SEEDLINGS GROWN IN DIFFERENT SUBSTRATES

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Summary

This study was carried out to determinate the some quality of tomato (Falcon standard variety and Lice genotype) seedlings grown in different substrates during spring season of 2021 year. In the study, the seeds of tomato were sown in 350 cc capacity drained pet glasses filled with different mortar substrates in greenhouse of the Horticulture Department of the Faculty of Agriculture of Dicle University.

As growing substrates of mortar used in the study; Soil (Control), Soil + Perlite (3/1 ratio), Soil + Water Retaining Polymer (3/1 ratio), Soil + Perlite (3/1 ratio), Soil + Vermiculite (3/1 ratio) and Peat + Perlite (3/1 ratio) were prepared as mortar materials.

In the study, it was found that different mortar materials were effective on the parameters taken in tomato seedlings ($p<0.01$). As a result of the measurements and observations, the best results were taken in Lice genotype respectively; peat + perlite > soil + polymer > soil + vermiculite > soil + perlite > soil. Seedlings of Falcon variety were obtained in the order of peat + perlite > soil + perlite; similar results were obtained in other mortar.

The results obtained at the end of the study, it was determined that the use of peat perlite mixture mortar material or soil and water-holding polymers instead of only soil contributed to the development of seedlings.

Keywords: *Growing, Mortar, Quality, Seedling, Tomato*

PHYSIOLOGICAL RESPONSE OF BASIL (*OCIMUM BASILICUM* L.) TO WATER STRESS

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Summary

Basil (Ocimum *basilicum* L.; Lamiaceae), an annual herbaceous plant, is one of the most widely cultivated medicinal and aromatic species in the world, with its origins traced back to India. It has been used as a spice throughout the world for centuries, and recently, there has been an increasing focus on its medicinal properties. Like all other plant species, basil is often exposed to adverse environmental conditions due to recent climate changes, such as soil water deficiency. The objective of this study was to investigate the physiological changes occurring in the basil plant when exposed to water stress and to determine its tolerance and adaptability levels. The experiment was conducted in a greenhouse at the agricultural experimental station of the Faculty of Agriculture and Food Science in Sarajevo. Four drought stress levels were tested: control variant (no drought), low (three days without water), medium (six days without water), and high stress levels (nine days without water). To examine the physiological response of basil to drought, the following physiological parameters were evaluated: proline content, photosynthetic pigment contents, total protein content, antioxidant enzyme activities (guaiacol peroxidase, pyrogallol peroxidase and catalase), total phenolic and flavonoid content and total antioxidant capacity in the basil leaves. In this study, with increasing the intensity of drought stress, the amount of chlorophyll a, chlorophyll b and total carotenoid content decreased. On the other hand, the increase in drought stress resulted in higher antioxidant enzyme activities, higher proline and protein accumulation as well as higher total phenolics, total flavonoids and total antioxidant capacity in the basil leaves. These results lead to the conclusion that the basil plants have the ability to produce protective macromolecules and antioxidants in high amounts even in severe drought conditions, suggesting that basil could be considered as a drought-tolerant plant species.

Keywords: *basil, water stress, drought, resistance, defense mechanisms*

INFLUENCE OF CULTIVATION LOCATION ON THE CONTENT OF ESSENTIAL OIL AND BIOACTIVE COMPONENTS OF MEDICINAL PLANTS

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Summary

The use of medicinal and aromatic plants has always interested humans. These plants are grown to obtain fresh and dry mass and essential oils for the food, cosmetic, and pharmaceutical industries. Recently, there has been a growing interest in high-quality cultivation technology. Given that the quality of these plants is related to the content of secondary metabolites, the aim of this work is to research the influence of the location of cultivation on the content of bioactive compounds of medicinal plants. The research was conducted with five medicinal plant species (lavender, lavandin, sage, rosemary and immortelle) at two locations (Butmir and Kakanj). The tested traits were essential oil, total phenolic, flavonoid, and antioxidant capacity. The results indicated that the species of plant and cultivation location significantly impacted these traits. For example, the essential oil content ranged from 0.21 mL/100 g (immortelle) to 8.40 mL/100g (lavandin). Immortelle had the highest total phenol content at 36.09 mg GAE/g, while Lavandin had the lowest at 0.68 mg GAE/g. Additionally, the bioactive components in the plants varied depending on the cultivation location.

Keywords: *medicinal plants, cultivation location, essential oil, total phenolic, and antioxidant capacity*

SOIL CONDITION OF GREEN AREAS OF THE NOVI GRAD MUNICIPALITY IN THE CANTON OF SARAJEVO IN THE CONTEXT OF PERFORMING THE ECOLOGICAL FUNCTIONS OF THE SOIL

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Summary

Urban soils have become a critical component of sustainability urban ecosystems, providing important ecological services such as soil fertility, carbon storage, water filtration and water holding capacity, binding of heavy metals and biodiversity maintenance. However, urban soils face significant pressure from anthropogenic activities, leading to soil loss and degradation of their functionality. Traditionally, soil quality research has focused on agricultural and forest land, while urban soils have often been neglected. These studies are essential for quantifying urban soil quality and understanding their role in the sustainable development of cities. This paper presents the results of soil analysis of green urban areas under grass, under trees and arable soil at three locations in the Novi Grad municipality, Sarajevo Canton, with the aim of assessing the current state of soil of urban green area and contribute to better urban land management. The tested soils are mostly sandy loam with a slightly alkaline pH reaction. The carbon stocks up to 30 cm soil depth on average for all three locations are 7.44 kgC/m2, and the highest in the soil under the trees is 8.08 kgC/m2. The average value of water holding capacity is 43.96%vol, and permeability is usually low to medium intensity. The average value of the C/N ratio is 13:1, and the highest in cultivated soil is 14.3/1 on average. Available phosphorus and potassium vary by location from low to high supply, depending on the fertilization of green areas, while the concentrations of heavy metals did not exceed the permitted values in any investigated location.

Keywords: *Urban soil quality, ecological services*

EFFECT OF TREATMENT WITH DIFFERENT CONCENTRATIONS OF INDOLE BUTYRIC ACID (IBA) ON THE ROOTING OF ELDER CUTTINGS (*SAMBUCUS NIGRA* L.)

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Summary

In this work, the influence of different concentrations of indole-butyl acid on the development of roots, one-year-old and two-year-old hardwood cuttings (*Sambucus nigra* L.) was investigated. Both types of cuttings were treated with three different concentrations of indole-butyl acid in liquid form (500 ppm, 800 ppm, and 1000 ppm), including the control variant of one-year-old, and two-year-old hardwood cuttings, (without the application of hormones).

The parameters examined at the end of the experiment were: the percentage of rooting of the cuttings depending on the hormone treatment, the length of the adventitious root depending on the hormone treatment, and the fresh mass of the roots also depending on the hormone treatment.

The use of indole-butyl acid in a concentration of 0.8%, i.e. 800 ppm, proved to be the best because it had the greatest effect on increasing the value of all tested parameters of the cuttings.

Keywords: *cuttings, indole-butyl acid, concentrations*

INFLUENCE OF PGPRs ON THE PRODUCTION OF PHARMACOLOGICALLY ATTRACTIVE SECONDARY METABOLITES IN BASIL

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Summary

The inoculation of plants with plant growth-promoting rhizobacteria (PGPR) such as *Azotobacter*, *Streptomyces,* and *Bacillus* are well known to lead to improvement in germination, growth, and yield. In this study, effects of inoculation with selected PGPR isolates on the production of pharmacologically attractive secondary metabolites in basil (*Ocimum basilicum* L.) were investigated. Basil is a medicinal, aromatic and spicy plant species with a long tradition of use. The basil herb is used in traditional and homeopathic medicine as a carminative, spasmolytic, sedative and tonic. Also, it is widely used in food industry and cuisine of many regions of the world. One of the main phenolic compounds in basil is rosmarinic acid, with antiviral, antimicrobial and anti-inflammatory properties. The following parameters were determined: total phenolic content, total flavonoid content, and radical-scavenging capacity (DPPH-RSC). Our result showed that inoculation with PGPR increased production of rosmarinic acid. This was accomplished by determining the phenolic compounds by HPLC PDA method. The application of microorganisms used in this study had a positive effect on the examined parameters, and this study can serve as a basis for further research and formulation of technical solution for the production of microbiological preparation that would improve production and increase the content of pharmacologically attractive secondary metabolites.

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Keywords: *basil, HPLC, rosmarinic acid.*

EFFECTS OF ZINC AND HUMIC ACID APPLICATIONS ON YIELD AND ESSENTIAL OIL CONTENT OF OREGANO (*ORIGANUM VULGARE* L. SUBSP. *HIRTUM* (LINK.) IETSWAART)

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Summary

The aim of the study was to determine the effect of different soil Zn application doses under the conditions of with and without soil humic acide fertilization on the essential oil content and yield of Oregano (*Origanum vulgare* L. subsp. *hirtum* (Link.) Ietswaart). A field experiment was carried out during 2023 and 2024 at the Faculty of Agriculture of Eskisehir Osmangazi University, Turkiye. The seeds of *Origanum vulgare* subsp. *hirtum* (cv. Tınmaz), were used as experimental material. Experiments were carried out with 25 kg Zn ha^{-1}, 50 kg Zn ha^{-1} (as $ZnSO_4.7H2O$) and without Zn fertilization to the soil under humic acid 50.0 L ha^{-1} and 0.0 L ha^{-1} (control) conditions, applied to soil at the vegetative stage, beginning of the blooming stage and full blooming stage in both years. The essential oil content between Zn doses differed significantly under humic acid and control conditions especially in the first year and differences between years were determined.

Keywords: *Oregano, humic acid, zinc, yield, essential oil*

THE INFLUENCE OF FERTILIZATION AND THE VARIETY OF RED CLOVER (*TRIFOLIUM PRATENSE* L.) ON THE PRODUCTIVE AND QUALITY PROPERTIES OF FORAGE

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Summary

Red clover is behind alfalfa in distribution and importance in producing voluminous fodder. Alfalfa is better quality and more productive than red clover. However, in Bosnia and Herzegovina (B&H), large areas of land are not suitable for growing alfalfa (heavy, acidic soils), and because of this, clovers occupy larger areas than alfalfa. Red clover grows well in cool, moist, medium to heavy soils with a slightly acidic to neutral reaction. The quality and productivity of forage plants, including red clover, depend on soil fertility, assortment, ecological conditions and the degree of plant development during harvest. The aim of this research was to determine the influence of fertilization (N0, N20, N40 and N60) and varieties of red clover (Global and Una) on the yield of dry mass and crude proteins, and the number of nodule bacteria on the plant roots in the agroecological conditions of Butmir (B&H). The research results showed that the application of nitrogen fertilizer and the variety of clovers significantly affected the production-quality properties of voluminous fodder. The fertilization N60 with the Global variety (8.48 t/ha) and the N40 fertilization variant with the Una variety (8.50 t/ha) achieved the highest dry mass yields. The highest crude protein yield was recorded with N60 fertilization (1,262.1 kg/ha) for the Global variety or N40 fertilization (1,073.9 kg/ha) for the Una variety. The highest crude protein yields were recorded with N60 fertilization (1,262.1 kg/ha) combined with the Global variety or N40 fertilization (1,073.9 kg/ha) combined with the Una variety.

Keywords: *Red clover, variety, fertilization, dry weight, crude protein*

IMPACT OF MULTIFUNCTIONAL PYROPHYLLITE FERTILIZER ON SOIL PROPERTIES, GROWTH AND YIELD OF CARROT (*DAUCUS CAROTA* L. SUBSP. *SATIVUS*)

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Summary

A field experiment was conducted in Banja, Aranđelovac, Serbia with two types of fertilization (control: NPK 15:15:15 30 g/m2, plant residue compost 5 kg/m2 and experimental: NPK 15:15:15 30 g/m2 plant residue compost 5 kg/m2 with 500 g/m2 MPF addition) to determine the impacts of Multifunctional pyrophyllite fertilizer (MPF) on soil properties, growth and yield of carrot (*Daucus carota* L. subsp. *sativus*). At the end of the experiment, growth parameters such as leaf length, root fresh mass, root length and diameter were measured. Above-mentioned parameters were 8.68%, 18.54% 10.52 %, 9.27% higher in experimental treatment with MPF respectively. The pH value of the soil on which carrots were grown in the experimental treatment increased from 5.1 (in H2O) before fertilization with the MPF to 6.6 after harvesting carrots. This ecological MPF, which improving soil properties, slowing nutrient release, and enhancing plant nutrient uptake efficiency, is composed of pyrophyllite and dolomite from the Parsovići, Konjic, BiH. The sum of secondary macronutrients (CaO and MgO) contained in MPF is higher than 18% which confirms that this product fulfilled the requirements of EU Regulation 2019/1009. Experimental results showed that the application of MPF had a positive effect on leaf length, length and root diameter of carrots. At the same time, it also had a positive effect on the mass of the leaves, and especially the root, which is the most valuable part of the carrot.

Keywords: *pyrophyllite Parsovići, carrot, fertilizer, soil conditioning*

THE INFLUENCE OF MULTIFUNCTIONAL PYROPHYLLITE FERTILIZER ON YIELD AND CHEMICAL COMPOSITION OF BEETROOT (*BETA VULGARIS* L. VAR. *CONDITIVA*)

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Summary

The aim of this research was to examine the influence of multifunctional pyrophyllite fertilizer (MPF) on the growth of beetroot (*Beta vulgaris* L. var. *conditiva*) and the chemical composition of the root. A field trial was set up in Banja, Aranđelovac, Serbia with two types of fertilization (control: NPK 15:15:15 30 g/m2, plant residue compost 2.5 kg/m2 and experimental: NPK 15:15:15 30 g/m2 plant residue compost 2.5 kg/m2 with 250 g/m2 MPF addition). At the end of the experiment, the length of the leaves, roots, diameter of the roots and the weight of the whole plants, leaves and roots were measured. Leaf length, root length and root diameter 17.92%, 21.20% and 16.98% were higher compared to the control treatment respectively. Average mass of beetroot leaves and root at the end of the experiment were 47.81% and 44.65% higher in the experimental treatment. The pH value of the soil on which the beetroots were grown in the experimental treatment was higher compared to the control. This ecological MPF, which improving soil properties, slowing nutrient release, and enhancing plant nutrient uptake efficiency, is composed of pyrophyllite and dolomite from the Parsovići, Konjic, BiH. The sum of secondary macronutrients (CaO and MgO) contained in MPF is higher than 18% which confirms that this product fulfilled the requirements of EU Regulation 2019/1009. The application of MPF have a positive effect on the development of beetroot plant parts, especially the mass of the root as the most relevant part of the beetroot.

Keywords: *pyrophyllite Parsovići, beetroot, fertilizer, soil conditioning*

MONITORING OF RIVER QUALITY IN THE CITY OF GORAŽDE

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Summary

Surface water quality is a variable value that depends on the impact of many factors. Drina River Quality Testing was one of the main motives for the development of this work. In order to get as complete and accurate insihgt into water quality, we did the monitoring of water quality which lasted for two months (April-May). Sampling was carried out from five locations on the territory of the municipality of Gorazde at given time intervals, at the hydrological station, 500 and 1000 meters downstream and 500 and 1000 m upstream of it. The monitoring was carried out on the content of heavy metals: Pb, Cd, Fe, Zn, Cu, Ni and selected alkali and alkaline earth metals: K, Na, Mg, and Ca. In order to complete the analysis, basic physical and chemical parameters of water quality were also monitored: temperature, conductivity, redox potential, pH value and dry residue. The experiment was carried out in the laboratory of chemistry at the Faculty of Agriculture and Food Sciences in Sarajevo.

Despite numerous attempts to disturb river Drina recognizable quality, the measureed parameters do not show significant chemical contamination. The measured paramateres should be broaden in the future for organic polutants.

Keywords: *contamination, monitoring, evaluation, water quality*

AMMONIUM OXALATE EXTRACTION OF IRON TRIAD FROM NATURAL CLAY SAMPLES

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Summary

Acidic ammonium oxalate extraction is used to estimate the amount of amorphous or poorly crystalline iron in soils and sediments. Iron is the one element from the "iron triad" which have similar chemical behavior. Other two elements are nickel and cobalt. The aim of this study was to evaluate acid ammonium oxalate extraction of all elements from iron triad. The samples of natural clay were used in the investigation. Samples for total amounts of metals were prepared with microwave digestion with HNO_3 and HF, and measured by inductively coupled plasma-optical emission spectroscopy (ICP-OES). Ammonium oxalate extraction was done by earlier established procedure in acid medium and with absence of light. Measurements were conducted with atomic absorption spectroscopy with flame atomization (FAAS). For statistical evaluation, maximum, minimum, average, median and correlations were used. The investigated iron triad elements lie in the next sequence: Fe>Ni>Co. The poorly crystalline iron and ammonium oxalate extractable Ni showed higher correlation (r = 0.874) than ammonium oxalate extractable cobalt (r = 0.446), suggesting that iron and nickel are more similar regarding ammonium oxalate extractability.

Keywords: *iron, nickel, cobalt, clay, oxalate*

EFFECT OF CUTTING HEIGHTS ON THE YIELD AND SOME FORAGE QUALITY COMPONENTS OF SWITCH GRASS (*PANICUM VIRGATUM*)

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Summary

Switch grass (*Panicum virgatum*) is a vigorous warm season, native perennial grass planted for many purposes including forage, wildlife cover, and as a biofuel crop. Because of the adequate nutrients, such as a high crude protein (CP) content and quality of fibers, switch grass are widely used as forage. Cutting height -i.e. the stubble heights above soil surface, is an important consideration in the management of perennial forage production systems, as it has a crucial effect on regrowth rate, yield, quality, and persistence of forage crops.

An experiment was conducted in Turkey under typical Mediterranean climate environment to evaluate the effect of five different cutting heights (0, 5, 10, 15 and 20 cm) on forage yield, and nutritional values of switch grass. Three harvests (50% heading stage) were performed during the growing season. Plant height, number of tiller, dry matter (DM) yield and crude protein (CP) content were measured in the study. Results indicated that cutting heights significantly affected yield and nutritional value of switch grass. The effect of deeper cuts tended to reduce digestibility of cell wall compounds. Total CP yield was significantly higher at 10 cm cutting height than the others were. Stubble height of 10 cm can be recommended throughout the growing season for forage production of switch grass with acceptable DM yield and forage quality, and for the safe operation of the harvest equipment.

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

MODELING A SUSTAINABLE SUPPLY CHAIN FOR ORGANIC BERRY PRODUCTION AND PROCESSING

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Summary

The issue of sustainability in the supply chain of organic berry production and processing is a critical factor in maintaining existing plantations and fostering new developments. Current practices between buyers and producers in the organic berry sector have not yielded satisfactory long-term results in a volatile market. This has led to a noticeable decline in the cooperative network and a reduction in both the number and size of cultivation areas. This paper presents an analysis of supply chains using the Canvas model, highlighting the current state, identifying its shortcomings, and emphasizing opportunities for developing new models. These models, if implemented, hold the promise of establishing a more effective supply chain for the production and processing of berries, bringing about a positive change in the industry.

Keywords: sustainable supply chain, organic berry production, processing, Canvas model, market volatility, cooperative networks, supply chain development.

PSEUDOMONAS SP. IMPROVES ALFALFA (*MEDICAGO SATIVA* L.) GROWTH IN COPPER-CONTAMINATED SUBSTRATE

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Summary

Copper is essential for plant growth, but excess levels disrupt photosynthesis, nutrient absorption, and inhibit overall growth. Major cause of excess Cu in soil is anthropogenic activity. Plants evolved an array of mechanisms which enable compensation of heavy metal induced damage. Interactions with plant growth-promoting (PGP) rhizobacteria is among more potent ones. Medicago sativa L. is a model plant with significant use in soil improvement. To evaluate M. sativa's bioremediation potential, we analyzed its morphological and physiological traits in Cu-contaminated soils. In order to evaluate the effect of plant-microbial interactions on the plants' overall status, we also applied seed priming using a Pseudomonas sp. strain with known PGP traits: tolerates high concentration of Cu, produces siderophores, utilizes atmospheric nitrogen, synthetizes IAA (indole acetic acid), and inhibits ethylene synthesis. Surface sterilized seeds were incubated overnight in liquid bacterial culture prior to the planting into pots. Imbibed seeds without inoculum were used as a control series. The pots were placed in plant growth chamber and provided with nutrient solution supplemented with 0 mg/L, 20 mg/L, 40 mg/L Cu. Morphological analysis revealed substantial differences in root length and density between inoculated and control plants. In the presence of 20 mg/l or 40 mg/l Cu, primed plants showed significantly higher ($p<0.05$) production of chlorophyll a, b and carotenoids, phenolic compounds, proline and superoxide dismutase in substrate. These findings indicate Pseudomonas sp. stimulates plant immune system by increasing the production of different physiological compounds involved in plant stress response.

This research was supported by Ministry of Science, Higher Education and Youth, Canton Sarajevo (grant No:27-02-35-37080-7/23).

Keywords: Medicago sativa, Cu toxicity, plant growth promoting bacteria, plant resilience

INNOVATIONS IN FOOD SCIENCE AND NUTRITION

BENEFITS AND RISKS OF USING EDIBLE FLOWERS IN DIET

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Summary

Flowers that can be consumed without harmful effects on human health are called edible flowers. Changing eating habits and lifestyles of consumers have increased the demand for healthier food. Edible flowers are a storehouse of bioactive ingredients with numerous health benefits, including antioxidant, anti-inflammatory and antimicrobial properties. The consumption of edible flowers has been recorded in various cultures as part of traditional cuisine and alternative medicine, and as decoration. Flowers also have significant nutritional value as a source of protein and essential amino acids. These properties make it important for the expansion of the food market due to its sensory and nutritional characteristics beneficial to health. Research into consumer behavior and purchase intent reveals ways to capture this promising market. Nutritional properties, pharmacological benefits, chemical composition and forms of preparation of edible species are increasingly studied, stimulating the demand for natural and healthy food. Modern methods of extracting bioactive compounds enable the development of functional ingredients for the food industry. However, risks associated with the consumption of edible flowers include the possibility of allergic reactions, pesticide contamination, and a lack of standardization in flower identification and processing. Therefore, it is necessary to establish proper taxonomy and toxicological profiles and to develop good practice manuals for the management (cultivation, handling and preparation) of flowers for commercialization. This paper aims to investigate in detail edible flowers, their nutritional and pharmacological benefits, as well as the potential risks associated with their consumption.

Keywords: *nutritional properties, bioactive compounds, allergic reactions, alternative medicine.*

GROWTH AND SURVIVAL OF PROBIOTIC BACTERIA IN FERMENTED PLANT-BASED BEVERAGES

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Summary

Probiotic bacteria in fermented plant-based beverages have aroused great interest among both scientists and consumers. Factors such as lactose intolerance, milk protein allergies, personal dietary preferences and many more underline the increasing popularity of plant-based alternatives. Plant-based fermented beverages generally do not contain probiotic bacteria, the addition of which could increase nutritional value and health benefits. This study aims to investigate the viability and proliferation of probiotic bacteria in fermented plant-based beverages made from oats and rice during the storage period. Fermentation of oat and rice beverages and monitoring the survival of probiotic bacteria over a 15-day period of cold storage were investigated and physical, chemical, rheological and microbiological analyses were performed every fifth day. The study showed that the number of probiotic bacteria (lactobacilli and bifidobacteria) in both beverages remained above 7 log CFU/ml throughout the storage period at constant pH, dry matter and ash content. Differences in colour and rheological properties were observed between fermented oat and rice beverages. This research shows that probiotic bacteria survive effectively in fermented plant-based beverages made from oats and rice. This suggests promising applications for improving the nutritional diversity and health benefits in alternative plant-based beverages.

Keywords: *oat, rice, plant-based beverage, fermentation, probiotic bacteria*

INHIBITION OF *BOTRYTIS CINEREA* USING NATURAL DEEP EUTECTIC SOLVENTS DURING POSTHARVEST STORAGE

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Summary

Postharvest decay poses a major challenge for fruit producers, leading to substantial annual economic losses. This issue is particularly pronounced in sweet cherries (*Prunus avium*, L.) consumed worldwide. Effective management strategies are essential to mitigate these losses and ensure the quality of harvested fruit.This decay in sweet cherries is often caused by the phytopathogenic fungus *B*. *cinerea*, which leads to grey mould. To control diseases caused by *B*. *cinerea*, new methods and antifungal agents are continually being investigated and discovered. This research aimed to examine the effectiveness of natural deep eutectic solvents (NADES) as biofumigants. Ten menthol-based NADES were tested in a *in planta* experiment.These include Menthol: Formic acid (Men:ForA), Menthol:Acetic acid (Men:AcetA), Menthol:Caprylic acid (Men:CapA), Menthol:Lauric acid (Men:LaurA), Menthol:Oleic acid (Men:OleA), Menthol:Pinene (Men:Pin), Menthol:Limonene (Men:Lim), Menthol:Eucalyptol (Men:Euc), Menthol:Camphor (Men:Cam) and Menthol:Thymol (Men:Thy). The experiment was conducted in hermetically sealed containers with three replicates. Sweet cherries were artificially infected with *B*. *cinerea* and placed at the bottom of the container, along with filter paper treated with NADES. Three concentrations (25, 50, and 100%) of each NADES were tested. After seven days of incubation at room temperature, the results were recorded by measuring the diameter of the infection and calculating the Area Under the Disease Progress Curve (AUDPC). All NADES except Men:OleA at a concentration of 25% inhibited the growth of *B*. *cinerea*, with an AUDPC value of 49. These findings suggest that menthol-based NADES can be considered as potential fungicidal agents during postharvest storage. This study provides a promising foundation for developing environmentally friendly postharvest treatments. Further research into the antifungal properties of NADES is warranted based on these results.

Keywords: *biofumigants, green solvents, NADES, postharvest decay, menthol*

THE INFLUENCE OF DIFFERENT DEHYDRATION METHODS ON CELERY ROOT SELECTED QUALITY PARAMETERS

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Summary

In present study, the influence of different dehydration methods (convective drying, lyophilization and combined osmodehydration and lyophilization) on the color parameters, sensory attributes and antioxidant properties of celery root, was examined. Celery root samples were dried convectively in a dryer at 50°C to a constant mass, in a lyophilizer for 48 hours, and by combined dehydration that included low-energy osmotic pretreatment in sugar beet molasses and shortened consecutive lyophilization for 24 hours. Subsequently, dehydrated samples were powdered and subjected to the color instrumental analysis (L, a, b coordinates), sensory analysis (color intensity, taste and odor) and analysis of total phenolic content and antioxidant activity (determined by ABTS and DPPH methods). The results revealed that convectively dried celery is darker than the combinedly dehydrated, with higher share of red and yellow tone. The most pronounced deviation from the standard taste and odor (grade 4) was characterized for convectively dried powder (grade 5.5 and 5.9), followed by combinedly dehydrated celery (grade 3.2 and 3.0). Regarding the influence of the dehydration type on the antioxidant potential, the combined method proved to be the most effective, DPPH 163.28 µmol TE/100 g d.m. and ABTS 577.28 µmol TE/100 g d.m, due to the molasses input (an excellent source of antioxidants) in the dehydrated celery root. The celery root powder previously osmodehydrated in molasses even had for 7.9% higher content of total phenols compared to the lyophilized powder, although lyophilization is considered one of the best dehydration methods in terms of preserving phenolic compounds.

Keywords: *Combined dehydration, Liophilization, Osmodehydration, Celery root, Antioxidant activity*

THE EFFECT OF STRESS ON EATING HABITS AND BODY COMPOSITION OF THE STUDENT POPULATION

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Summary

Obesity is emerging as a serious problem worldwide. One of the factors contributing to obesity is stress. It appears to be particularly important, as it leads to poor diet, lack of physical activity, lack of sleep. The transition from high school to a university can increase perceived stress levels, which affects eating behavior and metabolism. This change alone effects difference in eating habits than those in the general population- they rely on meals that can access quickly and easily. There are two main components of the stress response: the autonomic nervous system (ANS), which includes the sympathetic and parasympathetic nervous systems and the HPA axis.

The goal of research was to assess the impact of stress on eating habits and body composition of the student population. The respondents were 50 students from the Faculty of Agriculture and Food Sciences UNSA.

The devices used for body composition measurements are BIA-ACC and PPG Stress Flow (BioTekna S.r.l., Marcon-Venice, Italy). Statistical analyses were performed. Student's T-test was used to determine if there was a statistically significant difference between the parameters with regard to gender.

The biggest differences with respect to gender can be observed in the parameters of the HPA axis index ($p < 0,000$), which is one of the indicators of stress proving higher stress among women ($M = 3.836 \pm 0.4081$ vs. $F= 2.478 \pm 0.7499$) and between BMI in men and women ($p=0.23$). Men had a higher BMI than women ($M=24.445\pm3,1835$ vs. $F=21.614\pm3,6929$) but both in the normal weight category.

Keywords: *stress, obesity, BIA-ACC, PPG Stress Flow, body composition.*

BIOACTIVE COMPONENTS OF TEA, PROVING THE PRESENCE, STANDARDIZATION AND DETERMINING THE CONCENTRATION IN PLANT MATERIAL

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Summary

Tea is a warm drink, with specific aromas and flavors, containing valuable biologically active components such as phenols, vitamins, minerals, and alkaloids, which contribute to its unique properties and health benefits. The aim of this work was to determine the content of total phenolic compounds in different types of tea (*Camellia sinensis* - black, green, and white tea) and in herbal tea (*Mentha piperita*) using the Folin-Ciocalteau method. This method is based on spectrophotometry, allowing precise measurement of the total phenolic content, expressed as milligrams of gallic acid equivalents per liter (mg GAE/l). The highest content of total phenols was recorded in black tea, with a value of 44.2 mg GAE/l at a dilution of 1:8, followed by green tea with 38.5 mg GAE/l. White tea showed the lowest concentration of phenolic compounds among the *Camellia sinensis* teas, with a value of 19.4 mg GAE/l. In contrast, the herbal tea sample (*Mentha piperita*) had a phenolic content of 31.8 mg GAE/l, which was higher than that of white tea. The obtained results suggest that different types of tea contain varying amounts of bioactive components, primarily due to differences in processing methods, harvesting conditions, and the composition of the plants themselves. Black tea, due to its higher phenolic content, have stronger antioxidant properties compared to other teas, while white tea, with a lower phenolic content, may be considered a milder option. The findings highlight the importance of choosing tea types based on their specific bioactive profiles for potential health benefits and overall wellness.

Keywords: *bioactive components, phenols, Mentha piperita, Camellia sinensis, tea*.

EXAMINATION OF THE QUALITY OF TRADITIONAL SJENICA SHEEP'S HAM

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Summary

Sjenica sheep's ham is a traditional sheep meat product produced in households in the Sjenica municipality. Standard technology involves the following phases: bucks selection, slaughter, evisceration, carcass cooling, deboning and processing of raw "stelja", salting, then drying and smoking. The aim of the research was to examine the quality of traditional Sjenica sheep's ham by examining the composition of fatty acids, sensory and technological-chemical parameters. For the research, the samples were made into seven separate anatomical units (leg, loin, neck, breast, ribs, flank, hindshank), on which the tests were performed. Analysis of the composition of fatty acids revealed that monounsaturated fatty acids were the most abundant, followed by saturated and polyunsaturated fatty acids. From the MUFA group, the most represented was oleic fatty acid, from the SFA group palmitic and from the PUFA group linoleic fatty acid. According to the calculated nutritional indices (atherogenic, thrombogenic and hypocholesterol/hypercholesterol indices), the most nutritionally acceptable sample was breast. According to the sensory evaluation of the tested samples, the leg sample was rated the best, and the hindshank sample had the lowest overall sensory rating. By classifying the tested samples according to the overall sensory evaluation, five samples were classified as extra class and two as first class, which indicates a very good sensory quality of Sjenica sheep's ham. Technological-chemical tests revealed significant differences in the values of the examined parameters between samples from different anatomical regions. The hindshank sample had the highest salt and ash contents (11.61% and 12.63%), while the leg sample had the highest water activity and moisture content values (0.847 and 52.39%). The highest protein content was recorded in the flank sample (41.26%) and fat in the neck sample (37.10%).

Keywords: *sheep ham, traditional product, technology, quality*

EXAMINATION OF THE OIL QUALITY OF DIFFERENT NUTS

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Summary

Cold-pressed oils from nuts are among the highest quality and best oils for human nutrition. They are characterized by a pleasant taste and aroma, as well as good stability. Samples of cold-pressed walnut, hazelnut, and almond oils were prepared in laboratory conditions using a manual press, and analyses were conducted on fatty acid composition, nutritional indices, free fatty acid content, peroxide value, moisture content, and insoluble impurities. The analysis of fatty acid composition revealed that unsaturated fatty acids (UFA) were dominant in all three tested samples compared to saturated fatty acids (SFA). The highest content of unsaturated fatty acids (UFA) was recorded in almond oil (90.30%), while the lowest was in walnut oil (85.00%). The highest content of monounsaturated fatty acids (MUFA) was found in hazelnut oil (75.40%), with the lowest in walnut oil (19.20%). Among the MUFAs, oleic acid was the most prevalent in hazelnut oil (75.00%). The highest content of polyunsaturated fatty acids (PUFA) was recorded in walnut oil (65.80%), with linoleic acid being the most prevalent PUFA in walnut oil (49.00%). The highest content of saturated fatty acids (SFA) was found in walnut oil (15.00%), while the lowest was in almond oil (9.70%). Among the saturated fatty acids (SFA), the highest content of palmitic acid was found in walnut oil (10.00%), and stearic acid was recorded at 3.50% in both walnut and hazelnut oils. Based on the nutritional index values, hazelnut oil is the most nutritionally acceptable with the best fatty acid composition, as it exhibited low values of AI and TI indices, along with the highest HH index value.

Keywords: *nut oils, oil quality, fatty acids, nutritional value.*

THE INFLUENCE OF MICROWAVE HEATING AND ANTIOXIDANTS ON THE OXIDATIVE STABILITY OF COLD-PRESSED VEGETABLE OILS

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Summary

Lipid oxidation is a significant problem in the production, processing and use of edible oils, which causes significant changes in chemical, sensory and nutritional properties. Therefore, the aim of this research was to examine the influence of microwave heating and antioxidants, natural and synthetic, on the oxidative stability of cold pressed vegetable oils (rapeseed oil, sesame oil and milk thistle seed oil). Testing the sustainability of the tested samples with and without the addition of natural and synthetic antioxidants was carried out by microwave heating. Cumin and fennel essential oils were used as natural antioxidants, and propyl gallate (PG) and butylhydroxytoluene (BHT) as synthetic antioxidants. The test was carried out by determining the value of the peroxide number in the tested samples, first through the impact of microwave heating of different intensity at the same sampling time, as well as microwave heating of the same intensity sampled every 5 minutes up to a maximum of 25 minutes. By extending the time of microwave heating at constant power (140 W), the values of peroxide number increased in all tested samples with and without the addition of antioxidants. The biggest changes in the value of the peroxide number were recorded in milk thistle seed and rapeseed oil, and the least in sesame oil. Natural and synthetic antioxidants used stabilized milk thistle seed and rapeseed oil, while sesame oil could only be stabilized by synthetic antioxidant BHT. The best protection against oxidative deterioration was seen in BHT in all tested samples, as well as in fennel essential oil in rapeseed oil. With the increase of the power intesity of the device during microwave heating for the duration of 5 minutes, the values of the peroxide number of all tested samples increased, both with and without the addition of antioxidants. Using different powers of microwave heating (140 W, 280 W and 420 W), the best protection against oxidative deterioration of sesame oil was shown by PG, milk thistle seed oil by BHT and PG, and rapeseed oil by fennel essential oil and BHT.

Keywords: *oxidative stability, cold pressed oils, antioxidants, microwave heating.*

DEVELOPMENT OF NOVEL EDIBLE ANTI-STICKING MATERIAL FROM RAISIN PROCESSING WASTE: APPLICABILITY AS STARCH AND CITRUS FIBER ALTERNATIVES FOR WHOLE OR SLICED SUN-DRIED FRUITS

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Summary

This project aimed to develop an anti-sticking coating material from powdered raisin stem waste alternative to different starches and citrus fiber used extensively for sliced sun-dried figs and apricots, and whole raisins. For this purpose, raisin stem wastes separated in the processing plant were first washed effectively, and then dried at 90 °C for 1-1.5 hours until reaching the final moisture content of 5%. After that, the obtained raisin stem flour (RSF) was characterized for its water binding capacity (2 g/100 g) and functionality on whole raisins, and sliced sun-dried figs and apricots. The results clearly showed that the RSF prevented sticking problem of whole raisins and sliced sun-dried fruits better than hi-maize and tapioca starches during 12-months storage tests. In contrast, the anti-sticking performance of citrus fiber was superior than that of RSF. The results of this work clearly showed that the RSF could be applied successfully as a starch alternative anti-sticking coating to prevent sticking problems of sliced sun-dried figs and apricots as well as of whole raisins. The valorization of raisin stem flours as anti-sticking agent is an economically feasible approach that also fits highly to current sustainability approaches.

Keywords: *sustainability, waste assessment, anti-sticking coating, raisin stem waste*

NATURAL ENZYMES AND ALLERGIES

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Summary

Enzymes play a crucial role in speeding up chemical reactions in living organisms. Discovered in the late 19th century, these complex proteins are essential for various biological processes. Food allergies are immune responses to specific proteins in food. Common allergens include proteins from eggs, milk, peanuts, tree nuts, and seafood. Allergic reactions can vary from mild to severe and affect different body systems. The prevalence of food allergies is rising, with some estimates suggesting that up to 10% of the population may be affected. The aim of this paper is to investigate the influence of some natural enzymes on allergies. Enzymes used in food processing, like lysozyme in wine or alpha amylase in baked goods, can pose risks for those with sensitivities. Lysozyme, an enzyme that breaks down bacterial cell walls, can cause allergic reactions in some people, particularly those allergic to eggs. Similarly, enzymes like enolases and aldolases, which are involved in energy production, can trigger allergies, especially among those sensitive to fish proteins. Alpha-amylase, an enzyme that breaks down starches, is a well-known allergen, particularly in occupational settings like baking. Arginine kinase, found in seafood and insects, can also cause allergic reactions, which is a concern for people handling these products. Chitinase, which breaks down chitin in insects, and papain from papaya, used in meat tenderizers, can lead to allergies as well. Conclusion: Clearly specifying the natural or synthetic origin of potentially allergenic substances enables the avoidance of allergic reactions and directly contributes to maintaining the health of individuals sensitive to these ingredients.

Keywords: *lysozyme allergy, αlpha -amylase, chitinase, aldolase, papain*

PROFICIENCY TESTING FOR THE RP-HPLC ANALYSIS OF SOME FOOD ADDITIVES AND CAFFEINE IN BEVERAGES

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Summary

In many countries, the levels of food additives and caffeine are controlled by legal regulations, due the possibility of causing an adverse effect on human health. EU regulation requires validated and reliable analytical methods which could be used in official food control. For this purpose, a previous reversed-phase high-performance liquid chromatography (RP-HPLC) method with ultraviolet - diode array detection (UV-DAD) is fully validated, according to international guidelines. The chromatographic process is performed on a C-18 analytical column using isocratic elution and run time of 10 min. The aim of this study is to confirm that the validated analytical method for the determination of acesulfame K, saccharine, aspartame, sodium benzoate, potassium sorbate and caffeine in beverages is suitable and could be used in the official control of target analytes. The reliability of results was tested by participation in proficiency tests (PT) organized by FAPAS. PT provide an important mean in assessment the quality of routine measurements and they enable the laboratory to compare its own results with other laboratories. The test materials distributed were cola and tonic water drinks containing different concentration of analytes. Satisfactory scores were assigned to results of our participation in both PT schemes (z-score were < ± 2 for all target components). Successful participation in PT is considered proof of competence to accreditation bodies, regulatory authorities, as well as to customers. The obtained results revealed that the method is able to apply in the field of official control.

Keywords: *food additives, caffeine, beverages, RP-HPLC method, proficiency test.*

Acknowledgment

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THE PERCEPTION ON USAGE OF THE FOOD PRESERVATIVES BY CONSUMERS IN NORTH MACEDONIA

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Summary

Preservatives are one of the most commonly used additives in many food products, such as: soft drinks, fruit and vegetable products, processed meat, various sweet desserts, mayonnaise, ketchup, sauces, wines and beers, some types of milk products, etc. Their use in our country, as well as in other countries around the world, is regulated by law. As part of this research, an anonymous survey of different population groups (children, adolescents and adults) was conducted in order to determine how familiar consumers are with the term food additives, and especially with the preservatives, the benefits of their use versus the adverse effects on human health. The questionnaire consists of 29 questions, divided into 4 groups, namely Demographic data, Knowledge of healthy habits, Knowledge of additives and Knowledge and use of preservatives. The results of the survey conducted on 392 participants from North Macedonia show that the largest percentage of respondents (67.60%) answered that they know what preservatives are, but when asked to list which preservatives they know, only 26.28% of respondents answered correctly, 5.87% partially correctly, 8.42% incorrectly, and 59.44% did not know how to answer. When asked if they were informed about the risk of consuming large amounts of preservatives in the diet, 50.26% respondents answered affirmatively, 38.01% were partially informed, and 11.73% were not informed. The results of this research indicate that there is a need for better education and awareness of consumers about the use of preservatives in their diet, as well as about the risks of their intake.

Keywords: *consumer's perception, food preservatives, survey.*

APPLICATION OF ARTIFICIAL INTELLIGENCE IN FOOD: THE FUTURE OF NUTRITION AND SUSTAINABILITY

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Summary

Artificial intelligence (AI) brings significant innovations to food formulation processes and the development of personalized nutrition plans. Through advanced algorithms like artificial neural networks (ANN), AI can analyze extensive data sets to design optimal food formulations and dietary strategies. Regarding the capacity to interpret complex data patterns, ANN selects the best nutrition strategies based on individuals' specific health conditions, dietary preferences, allergies, and lifestyles. This technology not only supports the food industry in developing functional foods but also enables the design of personalized dietary plans, providing tailored solutions to consumers.

AI has become instrumental in creating healthier and more functional food products by streamlining data analysis and decision-making processes. In food formulation, it enables the assessment of nutrient combinations and their health benefits, resulting in products that are both health-oriented and appealing in taste. Similarly, AI-driven models help customize diet plans based on individual health needs, taking into account factors such as caloric requirements, vitamins and minerals, and dietary preferences.

AI is rapidly becoming a critical tool in delivering personalized solutions within the fields of food science and nutrition. By harnessing this evolving technology, more efficient and sustainable approaches can be implemented in food formulation and individualized nutrition planning. This review examines recent advancements in AI technology that are revolutionizing the agri-food sector, enhancing efficiency, reducing waste, and improving food safety and quality. It also explores the challenges, limitations, and future prospects of AI in food and agriculture.

Keywords: *AI, Personalized Nutrition, Functional Food, Dietary Strategies.*

MICROBIOLOGICAL INDICATORS OF THE QUALITY OF “VISOČKA PEČENICA”

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Summary

"Visočka pečenica" is a traditional cured meat product made from the highest quality batches of beef carcass. Since 2020, this product has been protected by the designation of geographical origin at the national level. As part of the research, the microbiological quality parameters of the raw material for the production of "Visočka Pečenica" and the final product were determined. For research purposes, samples of fresh beef from the thigh musculature and the finished product were used. Sampling was carried out in five stages of the technological production process. Research for the needs of this work was done at the Faculty of Agriculture and Food Scinece, University of Sarajevo. Microbiological analysis of the samples was carried out in order to determine the microbiological indicators in the tested meat samples: Staphylococccus aureus, *Clostridium botulinum*, the total number of bacteria from the family *Enterobacteriaceae*, the total number of lactic acid bacteria from the genera *Lactobacillus*, *Enterococcus, Leuconostoc, Pediococcus*, the total number of aerobic mesophilic bacteria and the total the number of yeasts and molds. On all nutrient media, the decreasing dynamics of microbial population growth during the production of traditional "Visočka pečenica" was determined, with variations in certain stages of brining that can be attributed to the adaptation of halotolerant bacteria to anaerobic environmental conditions. A characteristic increase in fermentative bacteria was proven only in the second stage of brining on the MRSV medium, and it did not change significantly even during the drying process, i.e. in the finished product.

Keywords: *“Visočka pečenica”, traditional product, quality indicators*,

LEGAL ASPECTS OF PROTECTING THE NAMES OF TRADITIONAL FOOD PRODUCTS IN THE EU

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Summary

For the last few decades, one of the main concerns of consumers in European Union has been, in addition to the health aspects of food, the potential impact on sustainability and animal welfare. Purchase decisions in modern era are often influenced by labels on the packages, where producers highlight key characteristics of product to attract consumers' attention. The legal framework of the European Union recognizes two main options for the protection and registration of the names of traditional food products: registration of individual, collective or certification trademark under Regulation (EU) No 2017/1001, and registration of geographical indication or traditional speciality guaranteed under Regulation (EU) No 2024/1143. Each of these two options has its flaws and shortcomings, and there are certain conditions regarding product itself that need to be met. This paper presents the results of a search of European Union registers, which reveal trends and preferences among producers regarding the modalities for registering names of food products. Furthermore, the central part of the paper includes an analysis of the conditions and legal aspects of registering names for each option. It turns out that producers prefer trademarks over geographical indications, but geographical indications are a much better modality of legal protection albeit with much stricter registration requirements. The results and recommendations from this paper can serve as a guide for producers in countries that are in the process of acceding to the European Union, helping them align with the trends present therein.

Keywords: *Traditional food products, Legal protection, Trademarks, Geographical indications.*

CHARACTERISTICS OF APPLE PEKMEZ PRODUCED IN TRADITIONAL WAY IN BOSNIA AND HERZEGOVINA

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Summary

One of the most well-known foods in Bosnia and Herzegovina is apple pekmez, which has been made on traditional method here for a long time. Because of its high energy content and abundance of both nutritional and non-nutritive components that have a good impact on human health, it is popular product among consumers. Since there are little published materials on the qualities of this valuable product in Bosnia and Herzegovina, the purpose of this study is to examine the processing method used in B&H for pekmez and how its affect products quality. Twenty-six apple pekmez samples - both sweet and sour- that took home awards from the "Tešanjski dani pekmeza 2021" fair, were examined. The obtained results demonstrated notable differences in the analyzed parameters between sour and sweet apple pekmez and within the same type. The samples had titration acidity contents ranging from 0.053g/100g to 0.387 g/100g. All samples were contained high amounts of total and reducing sugars. Apple pekmez's energy levels ranged from 124.56 kcal/100g to 317.69 kcal/100g for sweet samples.The sour pekmez showed the greatest HMF concentration, measuring 42.29 mg/kg. Based on the carried-out analyses, it can be stated that apple pekmez made in B&H on traditional method is an energy-dense food item that can be used to sweeten a variety of confectionary products as well as for the nutrition of athletes, kids and the elderly.

Keywords: *sugar, acidity, hydroxymethyl furfural, energy value*

PHENOLIC CHANGES IN OLIVES (*Olea europaea* L.) DURING THE NATURAL SPONTANEOUS FERMENTATION PROCESS

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Summary

Table olives are functional foods due to their high phenolic content. Among these, oleuropein with bitter taste, stands out as the most important compound in fresh olives. Therefore, the fruit has to undergo several processes to become edible. In our study, the natural fermentation process was used to debitter the fruits of the 'Leccino' cultivar. After harvesting, the olives were soaked in water for 1 month and then in 7% NaCl brine for 6 months. Eleven phenolic compounds were determined by UHPLC-MS every month during the processing method. The results showed compound specific changes during the natural fermentation process. In general, most of the phenolic compounds decreased over time, including oleoropein. Its content was highest in fresh olives (9802.2 mg/kg FW), while at the end of the process it decreased to 32.6 mg/kg FW. However, the contents of oleuropein aglycone, hydroxytyrosol and oleoside increased in the early stages of processing compared to those measured in fresh fruit due to the degradation of their precursor. The most abundant substances in the final products, which increased over time, were caffeic acid, oleacein and elanolinic acid. They accumulated due to the degradation of phenolics, which were the most abundant in fresh fruit.

Keywords: *table olives, phenolic compound, processing method, oleuropein, degradation compounds*

ASSESSING PESTICIDE RISK IN FRUITS AND VEGETABLES: A COMPREHENSIVE EVALUATION

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Summary

Climate changes, freshwater scarcity, diminishing arable land, and particularly the prevalence of harmful agents pose significant challenges to food production, necessitating robust plant protection measures. Contemporary science faces several key issues, including increasing concerns regarding food safety, the rising trend of organic farming, the emergence of resistant populations of pests, and the loss of biodiversity due to chemical pesticide use.

It is therefore crucial to protect consumers from exposure to unacceptable levels of pesticides through ongoing monitoring programs. Over the past decade, the presence of food containing pesticide residues has risen significantly, raising major safety concerns for consumers globally. Consequently, the detection and quantification of these residues in food have become paramount. Therefore, evaluation the adverse health effects of pesticides through risk assessment are still required. This is particularly important for food mainly consumed fresh, such as fruits and vegetables.

This study assessed the health risks associated with pesticide residues from the classes of diamides, spinosyns, strobilurins, and methoxycarbamates in various fruits and vegetables. The evaluation involved calculating the Estimated Daily Intake (EDI), Hazard Quotient (HQ), and Hazard Index (HI). The research was conducted based on findings from a dissipation experiment. Results indicated that the detected residue levels fell within safe limits, suggesting that their consumption does not present a significant health risk to humans.

Keywords: *pesticide residues, risk assessment, fruits, vegetables.*

PRODUCTION OF BREADSTICKS ENRICHED WITH HAWTHORN FRUIT

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Summary

The common hawthorn (*Crataegus monogyna*), is a member of the Rosaceae family that is native to Europe, Africa, and Asia. Scientific research has shown that the presence of various bioactive substances such as epicatechin and chlorogenic acid in hawthorn fruit results in strong antioxidant and free radical scavenging properties. This study investigated the preparation of hawthorn fruit-enriched breadsticks. The study aimed to produce a healthy snack with health-promoting effects and evaluate its nutritious and antioxidant properties. Breadsticks were prepared by adding different ratios of hawtorn to the dough (%5, 10,15). Proximate (moisture, ash, fat, protein), total phenolic content and sensory analyses were performed. Hawtorn-enriched breadsticks were compared with no hawthorn-added breadsticks. The sensory analysis showed only a color difference between the hawthorn containing different amounts of breadsticks. According to the evaluation of the participants, there was no statistically significant difference in odor, brittleness, flavor and general liking among the breadstick samples ($p>0.05$). According to the results, as the amount of hawthorn increased, the amount of total phenolic substance in the samples increased at a statistically significant level ($p<0.05$). This shows that the aim of enriching the phenolic content with adding hawthorn was successfully achieved. Further studies will focus on optimizing the recipe to show better sensory qualifications. As the functional food market is expanding and manufacturers are being forced by consumers' growing concerns about their own health to employ novel techniques, such as the use of natural sweeteners, modifiers, flavor enhancers, and preservatives.

Keywords: *Hawthorn, breadstick, total phenolic content, sensory analysis, bioactives*

MINERAL COMPOSITION OF MEAT FROM DIFFERENT SPECIES OF ANIMALS FROM SERBIA

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Summary

This study aimed to provide information on levels of magnesium (Mg), potassium (K), calcium (Ca), copper (Cu) and zinc (Zn) in 154 meat samples from six species of animals. Samples (chicken, turkey, pork, lamb, equine and beef meat) were gathered from different meat processing facilities in Serbia during 2023. The levels of macro- (Mg, K, Ca) and micro- (Cu, Zn) elements were determined by inductively coupled plasma mass spectrometry (ICP-MS). The highest significant mean content ($p < 0.05$) of Mg was measured in chicken meat. In terms of K and Ca levels, pork and equine meat had the highest values, respectively, and there were no significant differences between other meat species. Equine meat had the highest significant mean levels of Cu while the significantly highest Zn levels were determined in beef meat. The distribution of the elements in meat samples was examined by applying principal component analysis (PCA).

Keywords: *macro- elements; micro-elements; meat; species of animals.*

TECHNOLOGY, PHYSICO-CHEMICAL AND SENSORY CHARACTERISTICS OF INDIGENOUS GOAT CHEESE LIDER

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Summary

The technology and quality of Lider goat cheese are examined in this research. It is a hard, full-fat cheese produced from pasteurized goat's milk. Goat's milk is obtained from goats that are raised in the mountainous area of Nikšić, Montenegro. The aim of the work is to present the Lider goat cheese technology as well as to examine the physico-chemical and sensory characteristics of this cheese. Cheese samples were tested after ripening for 21 days (three weeks). The average chemical composition of the cheese was (g/100g): dry matter 62.64; fat 30.17; proteins 27.59; salt 3.96 and lactic acid 0.185. The average content of fat in dry matter (fat in DM), water in non-fat cheese matter (WNFM) and salt in moisture (S/M) were 48.94%, 54.42% and 10.89%. Average pH was 5.25, water activity 0.895, while hardness and stickiness were 13.844N and -0.213N. The average rind thickness of 2.57mm was established, while the average height and cross-sectional area of the cheese were 33.33mm and 9.57cm^2/100g. The average density of the cheese was 1.338g/cm^3. The total sensory evaluation averaged 17.34, which places this cheese in the high first class. One-factor analysis of variance ($p<0.05$) revealed that there is a statistically significant influence of the production day on all physico-chemical and sensory parameters of the cheese, except for the external appearance and color.

Keywords: *cheese, technology, quality, chemical, sensory*

CHARACTERIZATION OF HALOPHILIC/HALOTOLERANT ACTINOBACTERIA ISOLATED FROM ACTIVE MEAT CURING BRINE

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Summary

The present study was conducted to investigate the characteristics of halophilic/halotolerant actinobacteria isolated from active meat curing brine. Halophiles are microorganisms that survive in media where salt concentration is high, therefore they were categorized as extreme, moderate and slight halophiles. Three samples of active meat curing brine were collected during brining process (3., 13. and 23. day) of traditional *Visočka* pečenica production (traditional smoked dried beef). All samples were taken from the surface (aerobic conditions) of randomly selected 300L curing containers at 15°C, pH value of brine samples was 5,4, whereas during the whole brining process NaCl concentration in brine was >20%. A culture dependent approach on tryptone soya agar (TSA) was used to identify bacterial concentration range log 7,33, log 4,29 and 7,98 during brining process, retrospectively. Sixty (6) bacterial strains were selected, followed by selective cultivation on ISP media, growth in 20% and 30 % of NaCl, Gram straining, catalase reaction as well as cell morphology examination using light microscopy. The major present genera were *Nocardiopsis, Sacharopolyspora, Haloactinospora, Streptomonospora, Kocuria and Streptomyces*. Aerobic, halophilic, filamentous *Actinobacteria* were identified as dominant microflora of active meat curing brine. This extreme microbial consortium offers huge biotechnological potential for application in different biosystems.

Keywords: *Actinobacteria, active meat curing brine*

ANTIMICROBIAL EFFECT OF DIFFERENT TYPES OF HONEY ON GRAM POSITIVE BACTERIA

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Summary

Honey is an efficient antimicrobial agent with antimicrobial potential against a variety of microorganisms including multidrug resistant bacteria. In this study nine samples were analyzed, eight types of honey and one honeydew's sample, all differed significantly in botanical and geographical origin (five-Bosnia and Hercegovina, three-Serbia, one-Alpe region-Switzerland). This study aims to compare the effects of honey types and the honeydew against Gram positive bacteria: reference strains (*L. monocytogenes* LMGT 2653, *S. epidermidis* LMGT 3026, LMGT 2144, *L. innocua* LMGT 2785, *E. avium* LMGT 3465, *E. faecium* P21 LMGT 2876, *La. plantarum* LMGT 2003, *S. aureus* LMGT 3242, *La. sakei* NCDO 2714) and two multidrug resistant-type strains (*E. faecalis* 29 KF18-2, *E. faecium* 19 M1729-1). Disc diffusion method was carried out, whereas natural samples in line with three dilutions of honey samples with sterile Aqua dest. (1:1, 1:2, 1:3) were applied on Muller-Hinton agar media, previously inoculated with test bacteria. The natural bees harvested honeydew showed the maximal antibacterial efficiency against reference strain of *L. monocytogenes* LMGT 2653, although all analyzed dilutions of honeydew displayed the lowest inhibitory activity on all another Gram-positive bacteria.The sample of monofloral chestnut honey collected in western part of B&H (Velika Kladuša) showed the highest antibacterial activity against all analyzed strains including two multidrug resistant type strains. Different types of honey possess different efficancies against the same type of bacteria, whereas results showed that two multidrug resistant type strains were the most resistant, following by reference strains *Lactiplantibacillus plantarum* subsp. *plantarum* and *Latilactobacillus sakei*.

Keywords: *antibacterial effect, honey, Gram positive bacteria.*

DEVELOPMENT OF HPLC-DAD METHOD FOR IDENTIFICATION AND QUANTIFICATION OF PHENOLIC ACIDS IN VEGETABLES

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Summary

Polyphenols in vegetables are considered to be an important human dietary component and exhibit a tremendous antioxidant activity as well as other health benefits. One of the main group of polyphenols are phenolic acids. The term phenolic acids refers to a large number of naturally occurring compounds in fruits and vegetables. The objective of this investigation was development of HPLC-DAD method for determination of nine phenolic acids: gallic acid, vanillic acid, caffeic acid, chlorogenic acid, syringic acid, p – Coumaric acid, ferulic acid, sinapic acid, cinnamic acid. For that purpose a Lichrospher RP Select B (125×4 mm, 5 µm) column was used as stationary phase. Water, ACN, formic and acetic acid in various ratios were used as mobile phase. Different gradients were applied in order to separate the phenolic acids. Because the concentration of free phenolic acids in samples was small it was difficult to identify and quantify the acids in the samples. The target acids were identified in the spiked samples, suggesting that there were no matrix interferences. Retention times, as well as overlapped UV – spectra were used for successful identification in the investigated samples. Concentrating the samples is needful for determination of phenolic acids using this methodology. It will be the next step in our investigation.

Keywords: *polyphenols, phenolic acids,* HPLC-DAD*, fruits and vegetables.*

SYNTHESIS OF CHITOSAN-BASED BIOFILM IMPREGNATED WITH SILVER NANOPARTICLES

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Summary

This thesis focuses on the synthesis and innovative application of biofilms based on chitosan impregnated with silver nanoparticles. The combination of chitosan, known for its bioadhesive and antimicrobial properties, with the strong antibacterial action of silver nanoparticles, presents a promising synergy. The study investigates the process of synthesis, characterization techniques, and practical applications of these biofilm compositions.

By incorporating chitosan and silver nanoparticles, the biofilms exhibit enhanced structural integrity, bioadhesion, and antimicrobial efficiency. The research emphasizes the interaction between these components and explores their potential applications in various sectors, with particular attention to food safety. These biofilms could extend the shelf life of perishable products and reduce the risk of foodborne illness.

In summary, the paper highlights the transformative impact of biofilms impregnated with chitosan and silver nanoparticles. This innovative approach not only improves the functional properties of biofilms but also opens new avenues for application in health and food safety. The study offers valuable insights into the synthesis, characterization, and practical implications of these biofilm compositions.

Keywords: *Chitosan, Silver Nanoparticles, Biofilm, Antimicrobial Properties, Food Safety*

THE INFLUENCE OF DIFFERENT DEHYDRATION METHODS ON CELERY ROOT SELECTED QUALITY PARAMETERS

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Summary

In present study, the influence of different dehydration methods (convective drying, lyophilization and combined osmodehydration and lyophilization) on the color parameters, sensory attributes and antioxidant properties of celery root, was examined. Celery root samples were dried convectively in a dryer at 50°C to a constant mass, in a lyophilizer for 48 hours, and by combined dehydration that included low-energy osmotic pretreatment in sugar beet molasses and shortened consecutive lyophilization for 24 hours. Subsequently, dehydrated samples were powdered and subjected to the color instrumental analysis (L, a, b coordinates), sensory analysis (color intensity, taste and odor) and analysis of total phenolic content and antioxidant activity (determined by ABTS and DPPH methods). The results revealed that convectively dried celery is darker than the combinedly dehydrated, with higher share of red and yellow tone. The most pronounced deviation from the standard taste and odor (grade 4) was characterized for convectively dried powder (grade 5.5 and 5.9), followed by combinedly dehydrated celery (grade 3.2 and 3.0). Regarding the influence of the dehydration type on the antioxidant potential, the combined method proved to be the most effective, DPPH 163.28 μmol TE/100 g d.m. and ABTS 577.28 μmol TE/100 g d.m, due to the molasses input (an excellent source of antioxidants) in the dehydrated celery root. The celery root powder previously osmodehydrated in molasses even had for 7.9% higher content of total phenols compared to the lyophilized powder, although lyophilization is considered one of the best dehydration methods in terms of preserving phenolic compounds.

Keywords: *Combined dehydration, Liophilization, Osmodehydration, Celery root, Antioxidant activity*

EXAMINATION OF THE QUALITY OF COLD-PRESSED SESAME OIL FROM DIFFERENT PRODUCERS FROM BOSNIA AND HERZEGOVINA

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Summary

Cold pressing of the oil is an oil extraction process that is carried out without additional heating of the seeds. One of the samples used in the research was prepared in laboratory conditions on a hand press, while the other samples were purchased on the market in Bosnia and Herzegovina. The analysis revealed differences in quality between the tested samples of cold-pressed sesame oil from different producers in the territory of Bosnia and Herzegovina. The highest content of unsaturated fatty acids (UFA) was recorded in sample US1 (84.94%), and the lowest in sample US2 (79.80%). The highest content of oleic and linoleic fatty acid was in US1. The nutritional value expressed by the ratio of PUFA/SFA groups in sesame oil was in the interval 2.59 to 3.45, on the basis of which the examined samples can be declared as highly nutritious products. Highest values of the ratio of groups ω-6/ω-3 were recorded in the US1. In the tested samples, the highest AI index value was sample US2 and the lowest was sample US1. The highest value of the HH index was recorded in sample US1 and the lowest in sample US2. Sesame oil sample US1 had the lowest values of the free fatty acids, saponification and peroxide number. The best sample according to most parameters was sample US1. Although sesame oil is stable, it still loses its main properties during standing and storage. The freshest sample proved to be the best according to its components and nutritional composition.

Keywords: *oil, sesame, cold pressed, quality, stability*

APPLICATION OF NEW INNOVATIVE SOLUTIONS OF PREPARATIONS BASED ON ZEOLITH IN DIFFERENT PHASES OF PRODUCTION AT THE GRAPEVINE IN THE REPUBLIC OF NORTH MACEDONIA

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Summary

In the period from 2018 to 2023, we conducted research on the effects of the application of the innovative formula from the mineral zeolite on different stages of production in the grapevine in the Republic of North Macedonia.
The mineral zeolite originates from the mine excavations in Serbia. In the period from 2017 to 2018, a „new formula‟ was made from the zeolite preparation with processing, it was crushed into a powder form, with a certain particle size for easy application in a dissolved state. This type of processed zeolite is registered as a fertilizer and improver of soil properties and during that period it received an innovation award at a fair in Romania. We, in our country, continuously carry out tests using this preparation in several crops and it always gave positive results. In our study, the physico-chemical properties of this type of zeolite are shown, and then the results and the effect of the application on the vines are shown.
The main goal of applying this „innovative zeolite formula‟ was to reduce the use and uncontrolled use of pesticides in the fight to suppress diseases, pests, harmful weeds, etc. This is achieved in such a way that with the application of zeolite, which is environmentally friendly, the properties of the soil are improved, the plant makes better use of useful substances and water, in fact stronger, more resistant and immune plants to diseases, pests, harmful weeds, drought, frost are obtained. etc. At the same time, the use of pesticides is reduced, and the pollution of the environment is also reduced.

Keywords: *zeolite, innovation formula, property improver, pesticides, pollution*

CHOCOLATE: A SWEET MYSTERY UNVEILING THE HIDDEN TRUTHS OF HEAVY METAL ION CONTENT

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Summary

Chocolate as one of the most popular treat worldwide, regardless of age, beside numerous nutrients can contain heavy metals causing harmful effects on human health. This study aimed to determine the content of 13 metal ions (Na, K, Ca, Mg, Cr, Mn, Fe, Co, Ni, Pb, Cu, Zn, and Cd) in 22 different chocolate samples by flame atomic absorption spectrometry. In general, the content of 11 tested metals increased with the cocoa content, while the opposite was observed for Ca and Na. The essential metals levels in the analyzed chocolates were as follows: K (7201.5 mg/kg) > Ca (1801.9 mg/kg) > Na (1124.5 mg/kg) > Mg (501.3 mg/kg). The levels of Cd and Co in all samples were below the detection limits of the method, while Cr was found only in 7 samples (ranging from 0.2 – 0.6 mg/kg). Dark chocolates with >75% cocoa contained the highest levels of Cu (15.0 mg/kg), Fe (78.7 mg/kg), Mn (16.8 mg/kg), Ni (3.13 mg/kg) and Zn (24.9 mg/kg), while maximum Pb level was obtained in milk chocolate sample (0.7 mg/kg). Overall, the maximum allowable amounts set by the Regulation on Maximum Permissible Levels for Certain Contaminants in Food in Bosnia and Herzegovina (Official Gazette of BiH No. 68/14) were not exceeded for Mn, Fe, Cu, Pb, and Zn in all samples.

Keywords: *Chocolate; Heavy metals; Flame atomic absorption spectrometry*

EVALUATION OF TOTAL POLYPHENOLIC CONTENT IN DIFFERENT VEGETABLES CULTIVATED IN NORTH MACEDONIA

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Summary

Polyphenols are organic compounds that affect the quality of food and contribute in improving of nutritional characteristics of fruit and vegetables. In this research, the total polyphenolic content (TPC) was quantified in different vegetables such as onion, garlic, leek, spinach, swiss chard, zucchini, letucce, carrot, red and rose tomato cultivated in North Macedonian by UV-Vis spectroscopy. Analyzed samples were dried ten hours at 40 oC using dryer. Then polyphenols were extracted from dried samples with 60 % methanol. The extraction was performed using magnetic stirrer by constant mixing two hours at room temperature. TPC in extracts was determined in accordance with Folin - Ciocâlteu colorimetric method. The absorbance of the blue complex formed as a result of a reaction between polyphenols and Folin – Ciocâlteu reagent was measured at 760 nm. In order to estimate the TPC in samples the absorbance was compared with a gallic acid calibration curve in concentration region from 0,000404 mg/mL to 0,00404 mg/mL. TPC was expressed as mg GAE (gallic acid equivalents)/g dry weight DW). Under applied experimental condition the obtained TPC values ranged between 2,50 ± 0,19 (carrot) to 18,71 ± 0,27 (letucce) GAE ± SD. Highest amount of TPC was obtained in letucce, while smallest amount was observed in carrot.

Keywords: *polyphenols, UV-Vis spectroscopy, vegetables, Folin – Ciocâlteu reagent*

THE EFFECT OF SWEETNESS ON CONSUMER PREFERENCE FOR FOOD PRODUCTS

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Summary

The perception of sweetness is a psychophysical phenomenon in which a stimulus triggers a sensation. The intensity of sweetness perceived when consuming a specific food or beverage can be easily controlled by varying the concentration of sweet-tasting substances. A basic psychophysical principle states that increasing concentration up to a certain physical limit increases the intensity of sweetness perceived by the observer. Sweetness sensitivity can be measured beginning in early childhood. Sensitivity measures include the ability to detect differences in intensity, whereas hedonic measures assess liking or preference. Differences in preferences and sensitivity are influenced by factors such as age, gender, nutritional factors, genetics, lifestyle, illness, and so on, and have a particular impact on cross-modal interactions—when a stimulus in one modality influences responses in another. For example, adding flavor may affect the increase in sweetness perception. In this study, samples of juice and cake with varying concentrations of sugar and vanilla aroma were used. The goal is to determine the impact of sugar concentration on the perception of sweetness and aroma, the effect of vanilla aroma on the perception of sweetness, and the differences in perception between children and adults

Keywords: *Consumer preference, sweetness, vanilla aroma, perception*

HEAT TREATMENT INFLUENCE ON THE CONTENT OF BIOACTIVE COMPOUNDS AND ANTIOXIDANT ACTIVITY IN SWEET POTATOES (*IPOMEA BATATAS* L.)

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Summary

Sweet potato (*Ipomoea batatas* L.) from the Convolvulaceae family, is a product of high nutritional value with high content of sugar, fiber, vitamins, and minerals. Its characteristic color results from a large number of polyphenolic compounds, especially anthocyanins, which together with other phenolic compounds represent the main bioactive components. Processing is one of the most important factors that affects the content of bioactive compounds. This research aimed to determine bioactive compounds content and antioxidant activity and evaluate heat treatment influence (oven-baking, cooking, and steaming) on these parameters. Two sweet potato varieties (orange – Beauregard/flesh and purple-fleshed - 414 purple) were taken from a local producer, near the municipality of Visoko. The content of bioactive compounds (total phenols, flavonoids) and total antioxidant activity was determined using spectrophotometric methods (Folin-Ciocalteau, colored reaction with $AlCl_3$ and pFRAP, respectively). Heat treatments (oven-baking, cooking, and steaming) significantly impacted the content of bioactive compounds and antioxidant activity. Oven-baked samples showed the highest content of bioactive compounds two-way analysis of variance revealed a highly significant influence of different potato varieties and preparation/processing methods on the content of phenols, flavonoids and antioxidant activity in sweet potato tubers. Results showed a positive correlation between total phenols and flavonoids and antioxidant activity. Obtained results can be used as a good indicator of improvement in the quality of processed food.

Keywords: *Sweet potatoes, heat treatment, bioactive compounds, antioxidant activity*

FERMENTED FOODS AS A HEALTHY, NUTRITIVE, SUSTAINABLE FOOD AND EUROPEAN CULTURAL HERITAGE - PRESENTATION OF PIMENTO COST PROJECT

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Summary

Fermented foods (FF), present in all European diets, hold a strategic place due to their benefits in terms of nutrition, sustainability, innovation, cultural heritage and consumer interest. Their potential for improving human health, but also driving food innovation and local production in the next decades, has become highly relevant. The challenge of COST-PIMENTO (CA20128-Promoting Innovation of ferMENTed fOods) is to federate the scientific community and key stakeholders working on FF. The idea is to collectively advance scientific evidence of their health benefits, building a benefits/risk approach in order to promote multi-modal innovation and meet the expectations of European communities. Project has 5 working groups: WG1: Build a multi-actor operational network; WG2: Cartography of FF in the diet of COST Countries, Development and validation of the First Fermented Food Frequency Questionnaire (FFFQ); WG3: Health benefits and risks of fermented foods; WG4: Federating scientists and FF producers to boost innovation for society and WG5: Dissemination, training & events. WG2 will make use of different sources of existing data, such as historical and scientific literature, relevant internet sources, official FAO, EU and national statistics, nutrition/diet surveys, food production and consumption patterns, as well as personal communications with the main actors in the field in order to perform quantitative analyses and assessments as well as sociological overviews. The knowledge assembled in WG2 is an important input to WG3, WG4 and WG5 and will serve beyond the present Action for any upcoming EU project concerning FF.

Keywords: *Cost Action, PIMENTO, fermented foods, FFFQ, health benefits.*

THE IMPACT OF LOCALITY ON THE SENSORY PROFILE AND PHYSICOCHEMICAL PROPERTIES OF KEFIR GRAINS FROM BOSNIA AND HERZEGOVINA

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Summary

Kefir is a traditional fermented milk beverage originating from the Caucasus region. Unlike other fermented dairy products, kefir stands out due to its unique microbiota, which exists in the form of kefir grains. These grains are characterized by the dominant presence of lactic acid bacteria, yeasts, and acetic acid bacteria. The microbial diversity of kefir grains not only influences the sensory profile of kefir but also impacts other physicochemical, biochemical, and microbiological properties. One of the key factors affecting the microbiota of kefir grains is their geographical origin.

The aim of this study was to investigate the impact of kefir grains from Bosnia and Herzegovina on the sensory profile and physicochemical characteristics of kefir. A total of 26 grains were analyzed and subjected to sensory evaluation. Biomass, pH value, and acidity were measured over a three-month period, during which the grains reached full activity, followed by a sensory evaluation to determine potential differences. Key sensory attributes, such as appearance, color, consistency, aroma, and taste, were evaluated. The results revealed differences in biomass growth during the evaluation period, with average pH values ranging between 4.1 and 4.6. Additionally, during the sensory evaluation, a descriptive approach was used alongside numerical ratings to link the observed smell and taste characteristics to the presence of aromatic compounds such as aldehydes, ketones, esters, and others, as described in the available literature.

Keywords: *kefir, kefir grains, microbiota, sensory analysis*

THE EFFECT OF GREEN LENTIL FLOUR ADDITION ON SNACK PRODUCTION

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Summary

Enhancing the nutritional quality of plant-based food has become necessary since the research about plant-based nutrition is a trending topic. Legumes such as chickpeas, beans, and lentils are the main components for the fortification of these products. Green lentils are considered a rich source of dietary fibre and protein as well as low in fat. Therefore, it is highly preferred as a meat substitute for consumers. This study determined the influence of green lentil flours (GLF) in snack formulation in terms of nutritional, physical, and sensory analysis. The lentil flour was added in the formula as a substitute for wheat flour with the ratio of 5%, 10% and 20%. The total content of the phenolic compounds (TPC) in the snacks was determined by the spectrophotometric method, using the Folin Ciocalteu reagent, and expressed in gallic acid equivalents per gram of sample. According to the results, the nutritional qualities of snacks were improved by adding green lentil flour to the formula. Physical assessment pointed out that the brightness of snacks was slightly affected by enhancement, and the yellowness of samples increased by the addition rate. Furthermore, the sensory analysis pointed out that % a 10 addition of GLF into the snack formula had the highest score in terms of overall acceptability. This study showed that GLF addition can improve the quality and acceptability of the snack.

Keywords: *Green lentil flour, snack, sensory, nutrition, food*

DIET AS A SIGNIFICANT SEGMENT OF SUCCESS OF A TRIATHLON ATHLETE PARTICIPATING IN THE PROJECT: HUMANITY AS A FORGOTTEN OLYMPIC DISCIPLINE

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Summary

This work is the part of the project "Humanity as a Forgotten Olympic Discipline" which presents humanitarian expedition where athlete does 13 days of triathlon starting at the Faculty of Agriculture and Food Sciences, Sarajevo, Bosnia and Herzegovina and finishing at the top of the Olympus Mountain, Greece.

The primary goal of this project was to collect financial resources for the purpose of treating patients with cancer disease. Through realistic action, the triathlon athlete faced the extreme challenges which symbolically present a battle full of ups and downs which these patients are fighting each day. Triathlon is a sport that requires skills, effort, endurance and motivation. It combines three sports disciplines: running, cycling, and swimming. The athlete was engaged in these disciplines during his venture to the Olympus Mountain. Most important aspect of this humanitarian expedition was the will. The will to succeed equals the will to get well. In these extreme circumstances, the athlete had support from his team: project coordinator, doctor of medicine, nutritionist, climber expert and photographer.

Due to daily exhausting physical activity, the role of nutritionist took significant part in his endeavor. Hence, the dietary plan was adapted to the conditions of staying in camper vans and facing unexpected challenges.

Used methods are: Anthropometry (height, weight, BMI); BIA; software Program Prehrane 5.0; creating a dietary plan for 13 days including food preferences, energy needs and endurance parameters. Expected outcome refers to meeting the nutritional needs of the athlete with the aim of maintaining endurance and energy.

Keywords: *Humanity, triathlon, dietary plan, endurance, macronutrients*

TRADITIONAL DISHES OF BOSNIA AND HERZEGOVINA

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Summary

The culinary heritage of Bosnia and Herzegovina is an important part of its cultural identity, reflecting the country's history, geography, and ethnic diversity. Historical events and conquests brought dishes modified and accepted in this region over time. This work shows a significant traditional variation in culinary customs, reflecting the unique cultural diversity of Bosnia and Herzegovina. Materials for the study include books, journals, academic theses, video materials, websites, and live communication (interviews and conversations). Descriptive and analytical methods were used to document and analyze culinary customs. The descriptive method explained the ingredients, preparation methods and cultural significance of traditional dishes. The analytical method focused on comparing and contrasting these customs across different regions. The research revealed significant dish differences regarding preparation methods, names, and habits across the country. During research, we came across organizations of different events celebrating food. An example is Fišijada in Orašje which brings together fish and culinary enthusiasts from across the country, allowing them to compete in cooking and enjoy a variety of fish dishes. The ingredients include carp, catfish, and white fish such as bream or roach, onion, sweet and hot paprika, bay leaf, tomato sauce, and white wine. Preserving these customs is essential for maintaining cultural identity and heritage. Efforts to document and promote these culinary traditions can help preserve the cultural heritage of Bosnia and Herzegovina for future generations.

Keywords*: Bosnia and Herzegovina, culinary heritage, traditional cuisine, customs, culture preservation*.

NEED FOR AGRIBUSINESS TRANSFORMATION IN THE LIGHT OF UN SDG 2030

EXPERIMENTAL ECONOMICS IN AGRIFOOD AND ENVIRONMENTAL RESEARCH: EXPERIENCE OF THE FACULTY OF AGRICULTURE IN ZAGREB

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Summary

Experimental economics is increasingly recognized as an important tool for understanding the complexity of human behaviour in economic contexts. It provides empirical evidence that improves the understanding of consumer choices, risk perceptions and decision-making processes. By examining how individuals respond to various economic incentives and policies, experimental economics provides a framework for developing evidence-based strategies that can lead to more effective public policies and business practices, particularly in the agricultural, food and environmental sectors.

This work highlights the application of experimental economics in the context of the Faculty of Agriculture in Zagreb, where research initiatives aim to assess the public's willingness to pay for sustainable practices and products, such as organic farming and biodiversity conservation. has facilitated the application of experimental economics at the Faculty of Agriculture, enabling the assessment of consumer preferences and behaviour, ultimately contributing to evidence-based decision-making.

Despite the promising opportunities of experimental economics, such as increased scientific visibility and collaboration with international researchers, there are still some challenges at the FAZ, such as further financial constraints, limited laboratory facilities and the need for greater collaboration with industry stakeholders. By using experimental approaches, the Faculty of Agriculture aims to make an important contribution to sustainability and innovation in agricultural economics and environmental policy, thereby addressing the current challenges in these areas.

Keywords: Experimental Economics, Evidence-based Decision Making, Research examples

TRANSFORMATIONAL PATHWAYS TO CLIMATE – RESILIENT CROPS: A BLUEPRINT FOR A SUSTAINABLE AGRICULTURE FUTURE

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Summary

In the era of global climate change, rapidly changing environmental conditions, overexploitation of natural resources (land, water, the loss of biodiversity), prolonged drought, acidification and salinization of the soil, intensification of insects and pests, degradation of soil health, increased number of fires, and ever increasing population pose a serious threat to the agricultural sector. The UN Food and Agriculture Organization (FAO) estimates that there is a need to produce about 50% more food by 2050 in order to feed the increasing world population (FAO 2023). The 2030 Agenda for Sustainable Development highlights the critical role agrifood systems play in tackling global challenges such as malnutrition, poverty, the loss of biodiversity and ecosystem services, and climate change. In Southeast Europe, agriculture is currently facing numerous challenges such as decline in factor productivity, rising input costs, low income and production uncertainties due to adverse effects of climate change. Temperature, rainfall and carbon dioxide are the main drivers of climate change. Cropping practices (CP) that can reduce greenhouse gas emissions (GHGs) include crop diversity, minimum and no-tillage; cover crops; genotypes selection for effective water use and stress tolerance; diversifying crop rotations (crop mixtures and rotations; perennials, forage crops; dual purpose crops, incorporating nitrogen-fixing pulses in rotation); optimizing fertilizer amount, timing and application rate, sequestering soil carbon and agroforestry systems. Focus on future technologies for arid and semiarid conditions should be new breeding techniques for development of climate resilient crops, better management practices, precision agriculture, sensors, big data analytics and artificial intelligence. This technologies and innovations promote the sustainable use of natural resources and biodiversity, creating greater resilience to climate change. The paper highlights the importance of embracing diversified, systems-oriented, and science-based solutions with special emphasis on the development of climate smart crops for a sustainable agriculture future.

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Keywords: *climate-smart crops, climate change, transformational pathways*

WHO WANTS TO BECOME ENTREPRENEUR? A STUDY OF ENTREPRENEURIAL INTENTION AMONG THE POPULATION IN BIH

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Summary

Entrepreneurship drives innovation, creates jobs, and stimulates economic growth by introduction of new products, services, and technologies, while fostering a culture of creativity, resilience, and continuous improvement. The research aims to explore entrepreneurial intentions among people in Bosnia and Herzegovina and identify the challenges and opportunities that foster an entrepreneurial spirit among them. The research is based on similar study on entrepreneurial intention in Slovenia, utilizing Ajzen's Theory of Planned Behaviour, expanded with constructs from the Theory of Innovative Cognitive Styles. The research consisted of three phases: *(i)* an online survey of the general population (n=215), *(ii)* an online survey of entrepreneurs in the agri-food sector (n=17), and *(iii)* in-depth interviews (n=3) with entrepreneurs, at three different stages of the business life cycle. The effects of various factors on entrepreneurial intentions were analysed, including personal attitudes (PA), subjective norms (SN), perceived behavioural control (PBC), willingness to try (WTT), creativity/originality (CO), and opinion leadership/ambiguity (OLAP). The results of multiple regression showed that personal attitude, perceived behavioural control, and willingness to try have a statistically significant impact on entrepreneurial intention, while subjective norms, creativity/originality, and opinion leadership didn't. So, the development of entrepreneurship in Bosnia and Herzegovina can be improved through various initiatives inspired by the best European practices. It is very important to think about consumers, all other actors of society in the sense of offering them added values that build extended customer/community satisfaction through extended producers responsibility decreasing environmental footprint and improving the quality of life for all. Also, further research of different aspect of entrepreneurship is needed to provide adequate inputs necessary to build up business environment promoting entrepreneurship.

Keywords: *entrepreneurship, agri-food, entrepreneurial intention, Theory of Planned Behaviour, Theory of Innovative Cognitive Styles*

INTELLECTUAL CAPITAL AS A FACTOR FOR MORE EFFICIENT AGRICULTURAL PRODUCTION IN THE REPUBLIC OF CROATIA

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Summary

Economic flows in business enable actors to achieve better business outcomes. Despite encouraging progress in technological development, the state of the agricultural sector in the Republic of Croatia still lags behind that of developed countries. A modern business concept in agriculture requires special attention to be given to intellectual capital. Knowledge represents a specific asset in the market, but for it to have a business impact, it requires continuous improvement and expansion. Economic activity is significantly influenced by external factors such as oil prices, raw material costs, interest rate fluctuations, and various economic recovery programs. Engaging skilled professionals more actively should be seen as an opportunity to implement business reforms in interaction with the business environment in order to utilize market opportunities more efficiently. Therefore, this paper will investigate the relationship between investment in human capital and the implications such investments have on production growth, and consequently, on increasing the income of agricultural producers. The data used in this research will be sourced from the Ministry of Agriculture, the Ministry of Finance of the Republic of Croatia, and the Croatian Bureau of Statistics. The study will employ the OLS methodology, regression analysis, and correlation.
The aim of this paper is to examine the interdependence between education and economic growth, to demonstrate that agricultural producers can and should rely on human capital as an important source of economic growth.

Keywords: *knowledge, intellectual capital, agricultural producers, income, production growth*

AGRICULTURAL POLICY OF BOSNIA AND HERZEGOVINA AND THE CHALLENGES OF EU INTEGRATION PROCESS

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Summary

Agriculture in Bosnia and Herzegovina faces numerous challenges, including global crises such as the COVID-19 pandemic and the Russia-Ukraine war, regional issues like African swine fever, and increasingly severe impacts of climate change. On the other hand, Bosnia and Herzegovina is clearly committed to EU integration, as reflected in current state and entity-level strategic documents. Moreover, the country's efforts to accelerate the harmonization of its agricultural policy with the EU Common Agricultural Policy (CAP) have been further motivated by the granting of candidate status in 2022 and negotiation status in 2024 for full EU membership. This paper provides an overview of the development of agricultural policy in Bosnia and Herzegovina from 2013 to 2023 at the state and entity levels (including the Brčko District of BiH) to assess the level of harmonization with the EU Common Agricultural Policy (CAP) using the unique APMC methodology for classifying and visualizing agricultural budget transfers. The analysis covers three groups of measures: (1) market measures and direct support to producers, (2) structural measures and rural development measures, and (3) general agricultural measures. Key macroeconomic indicators such as gross value added, employment levels, and trade balance were analyzed to obtain a comprehensive picture of the current state of the agricultural sector and its significance for the economy of Bosnia and Herzegovina. An important contribution of the paper is comparing Bosnia and Herzegovina's agricultural policy with those of the Western Balkan countries. The main conclusion that can be drawn from this paper is that agriculture is an important sector of Bosnia and Herzegovina's economy, with budgetary transfers to this sector showing a growing trend. However, the process of harmonization with the EU acquis is slow and requires greater decisiveness from policymakers, faster adoption of the legislative framework, and appropriate legal solutions, along with the necessary institutional strengthening to address the current challenges of the EU integration process.

Keywords: *agricultural policy, BiH, EU, CAP, integration processes.*

HOW CROATIAN FARMERS PERCEIVE AND ADAPT TO CLIMATE CHANGE

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Summary

Climate change poses a significant threat to global agriculture, impacting crop yields, livestock productivity, and soil health. This study aimed to explore Croatian farmers' perceptions of climate change risks, consequences, and adaptation strategies. An empirical survey of 100 farmers was conducted to assess their awareness and experiences.

Results indicate that farmers are cognizant of climate change and its adverse effects, including market disruptions, increased pest and disease prevalence, and reduced yields. To mitigate these challenges, farmers have adopted various adaptation measures such as green manuring, cultivating resistant crops and breeds, and installing irrigation systems. However, financial constraints often hinder the implementation of these strategies.

The study highlights the need for continuous education, financial support, and government policies to facilitate climate change adaptation in agriculture. Farmers emphasized the importance of institutional cooperation and increased government involvement in addressing climate change challenges. By understanding farmers' perceptions and adaptation practices, policymakers can develop more effective strategies to support sustainable agriculture in the face of climate change.

Keywords: *climate changes, agriculture, perception, Croatia*

OPERATION OF DAIRY FARMS IN LFA, A FARM MODELLING APPROACH

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Summary

In this contribution, we provide an example of using the SiTFarm model to analyze the dairy farming sector in Slovenia, focusing exclusively on farms operating in Less Favoured Areas (LFA). These farms are typically smaller, family-run operations that maintain traditional farming practices, contrasting with large-scale production systems. The study aims to detail the economic indicators of this diverse group of farms and assess the significance of Common Agricultural Policy (CAP) measures. The findings reveal that these LFA dairy farms generally achieve modest economic results, averaging around 9.6 €/h. The economic outcomes are closely tied to factors such as herd size and the extent of cultivated land. Among these farms, the smallest operations tend to have the poorest economic performance, with some achieving only 2.2 €/h. Despite these challenges, certain farms within the group are expected to benefit significantly from the CAP reform, with the potential for substantial improvement in economic results. Dairy farms in LFAs play a crucial role in preserving biodiversity, maintaining rural landscapes, and supporting local communities. They are integral to environmental sustainability, yet they often face difficulties in achieving economic viability. For these farms, budgetary payments are a significant source of income, which has helped mitigate some of the financial challenges they face. However, the analysis indicates that after the CAP reform, a slight decline in economic performance is expected, with an average decrease of 4.4% in gross margin across most farms. Overall, the SiTFarm model provides valuable insights into the economic challenges and opportunities for dairy farms in LFAs in Slovenia.

Keywords: *Farm model, dairy farms, CAP, economic analysis, LFA.*

THE INFLUENCE OF SOCIAL MEDIA ON THE CONSUMER'S DECISION TO BUY FOOD PRODUCTS

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Summary

Social media represents a significant factor in shaping consumer purchasing decisions regarding food products. Various platforms such as Facebook, Instagram, and other social networks provide consumers with access to information, reviews, recommendations, and the experiences of other consumers. As consumers increasingly rely on online channels for gathering information and shopping, it becomes necessary for food companies to carefully plan and implement digital marketing strategies that not only increase product visibility, but also build consumer trust. Digital marketing makes it easier for companies to reach and create a connection with customers. Interaction on social media affects the perception of products, where consumers consider previous experiences particularly important before making a purchase decision. The primary aim of this paper is to analyze whether company activity on social media influences consumers decision to purchase food products. Additionally, the goal is to determine whether the socio-demographic characteristics of respondents influence their attitudes towards food product marketing on social media, and whether these characteristics impact the type of social media most frequently used for obtaining information about food products. In this research, primary data were collected using a survey. The survey results were analyzed using descriptive statistics, frequency distribution, analysis of variance, and regression. Based on the survey results, it was found that company activity on social media for marketing purposes influences consumer purchasing decisions regarding food products, as well as that the socio-demographic characteristics of respondents influence the type of social media most frequently used for obtaining information about food products.

Keywords: *social media, consumer behavior, purchase decision, food products*

THE ECONOMIC EFFICIENCY OF GEOTHERMAL HEATING SYSTEMS IN SMALL-SCALE GREENHOUSE OPERATIONS IN BOSNIA AND HERZEGOVINA

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Summary

Greenhouse vegetable production offers many advantages over traditional open-field cultivation methods. These benefits include regulating and controlling growing conditions, leading to higher crop yields, year-round production, and increased resource allocation efficiency. Many studies demonstrate that heating systems improve production in greenhouses, leading to increased yields and improved economic profitability. However, similar research is lacking in Bosnia and Herzegovina, particularly in regions with a continental climate. Therefore, the main goal of this study was to evaluate the economic efficiency of vegetable production in a greenhouse equipped with an additional heating system compared to one without such a system. The experiment was conducted in two 100 m^2 greenhouses using identical cultivation technology. The only main difference is the average winter temperatures achieved within the greenhouses. The results showed that the temperature in the two separate greenhouses was statistically significantly different in winter; however, the observed yields did not show a statistically significant difference. Unexpectedly, the economic results were contrary to expectations, with lower returns in the greenhouse with heating. The main reason is the higher costs associated with deprecation (for 633 EUR) and the geothermal pump's electricity consumption (for 358 EUR). In conclusion, it can be said that in this experiment, using the geothermal pump is not economically justified, and it is recommended to consider using this equipment under different conditions, such as larger greenhouse areas with improved insulation (double-layered plastic). Furthermore, conducting similar experiments at this location to confirm or challenge the results obtained in this experiment.

Keywords: *economic efficiency, greenhouses, Bosnia and Herzegovina, geothermal pump, continental climate.*

INFLUENCE OF STATE SUPPORT MEASURES ON YOUNG FARMERS' EMPOWERMENT IN NORTH MACEDONIA

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Summary

One of the most significant challenges for the future of the agricultural sector and sustainable development of rural areas in North Macedonia is the mass exodus of young population. In Macedonia, rural youth account for approximately 35% of the total population. Data from the farm registry show that the share of young farm holders of registered agricultural holdings up to 40 years take about 14%. Macedonia has foreseen series of mechanisms for support of young farmers in its national strategies and programs, such as direct financial support in agriculture and rural development measures. The focus of this study is to investigate the effects of the state support measures on young farmers in Macedonia, especially the effects on their farm management decisions. Data was collected by using a survey questionnaire distributed to 45 young farmers in the southeastern region of Macedonia. Descriptive statistics and correlation were applied for the data processing and analysis. The results revealed that about 50% of the young farmers receive state support through rural development measures designed specifically for young farmers. Correlation analysis confirmed a certain connection between the socio-economic characteristics of young farmers and the use of state measures, as education in the field of agriculture has proven to be an important prerequisite for optimal use of funds (0.236). Logistic regression confirmed the impact of experience in the field of agricultural activity on the use of state support measures among the young farmers (1.404). However, the support provided to young farmers is insufficient, and these findings can significantly help in giving directions for creating more targeted measures designed specifically for young farmers.

Keywords: *support measures, young farmers, correlation analysis, rural development policies*

THE COST PRICE OF GROWING LAVENDER *(LAVANDULA OFFICINALIS)* AND THE ECONOMIC EFFICIENCY OF ITS PROCESSING IN THE TERRITORY OF THE FEDERATION OF BOSNIA AND HERZEGOVINA

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Summary

Lavender is one of the Lamiaceae family's most famous ornamental, aromatic, and medicinal plants. It is widely used in the cosmetic, pharmaceutical and food industries and is an excellent honey plant. Plantation cultivation of lavender in BiH is still not as developed as in other countries. Still, an increasing number of farms and specialized farms recognise this culture's potential. Given the need for more research on the economic results of growing lavender in Bosnia and Herzegovina, this research aims to analyse the cost of growing fresh lavender and the economic efficiency of its processing. Primary data were collected with the help of surveys conducted on four farms, focusing on the necessary investments and operational costs of growing lavender and the income from the sale of dried flowers. The results showed that the cost of growing 1 kg of fresh lavender flowers ranges from 0.71 KM to 1.41 KM, which indicates significant differences between the observed farms. Lavender processing also showed different levels of economy among farms. According to this research, cultivating lavender in Bosnia and Herzegovina is an economically profitable option; however, it is necessary to research a more significant number of farms. Also, due to different applied agricultural techniques in the cultivation of lavender, economic results differ significantly from farm to farm, so one of the research recommendations is additional education of producers in this area to increase the economic efficiency of these farms with the improvement of production technology.

Keywords: *economic efficiency, lavender, Federation of Bosnia and Herzegovina*

SETTING A SCENE FOR SUSTAINABLE PUBLIC FOOD PROCUREMENT IN BIH

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Summary

Current eating habits are at the core of an unsustainable lifestyle, significantly contributing to environmental degradation, biodiversity loss, and the deterioration of land, water, and air, while also impacting health and quality of life. Given this influence, it is crucial to rethink how we use food and foster sustainable eating habits through public policies, such as nutrition programs in schools. This research aimed to identify the factors that either stimulate or hinder the efficiency and effectiveness of food delivery programs in schools, a key element for encouraging sustainable lifestyles. Primary data was collected via a highly structured online survey (n=396), distributed through social media, forming non-conventional sample. Additionally, two focus groups with high school students were conducted to explore obstacles to organize nutrition programs in schools. Among the barriers, most prominent are associated with low involvement in preparing meals at home, low offer of "healthy" alternatives, and predominant offer of fast-food restaurants near the schools. Secondly, low engagement (low activity in associations and limited use of social media for learning about food choices, fashion and for getting advice) limits networking decreasing capability to share knowledge and good practice, impacting public policies results. Despite quite high level of awareness about negative environmental impacts of food system, current food behaviour is still strongly focused on food with high environmental footprint such as meat, milk, tropical fruit, highly processed food. So, to overcome these limitations it is necessary to develop plan that involves all the stakeholders, to raise awareness about externalities caused by current dietary patterns, and then slowly start with green and sustainable public food procurements, followed by activities directed towards the development of sustainable food environment in Bosnia and Herzegovina.

Keywords: *eating habits, school nutrition programs, sustainability, food policies, challenges*

TOWARD A CIRCULAR ECONOMY IN BIH: LESSONS LEARNT FROM AGRI-FOOD AND HORECA INDUSTRY

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Summary

Transition towards a circular economy in Bosnia and Herzegovina is still in its early stages, requiring the identification of challenges, obstacles and knowledge gaps, to ensure the transformation proceeds with the desired direction and intensity. Therefore, the main aim of this paper is focused on understanding the knowledge level, motivation and level of intensity, and readiness to implement circular economy practices in (i) agri-food companies (n=23) and (ii) companies in HORECA sector (n=26). The research was conducted through in-depth interviews with key informants and an online survey distributed online, forming a non-conventional sample. The research highlighted several obstacles for further transformation towards circular business models, starting with those concerning short supply chains, limited quantity and quality of local raw materials, insufficient commitment to reducing food waste, and barriers to donating leftover and excess food. There is low strategic orientation on circular economy models, still with traditional oriented strategic goals of the companies. Motivation for transition is noted, however, as a result of the very low level of knowledge required to transform business according the circular economy principles, the implementation level remains very low. Ultimately, companies placed expectations on governments to lead the shift towards circular economy models. Such results call upon an urgent need to intensify efforts to promote circular business models, to facilitate the introduction of a wide range of measures from education programs, training and research, financial incentives, to networking incentives aimed at connecting rural and urban areas and building partnerships for innovation and knowledge transfer between companies, centres of excellence, governments and civil society.

Keywords: *circular economy, transition, sustainable practices, food industry, HORECA,*

BOOSTING ENTREPRENEURIAL SPIRIT FOR RURAL REJUVENATION: AN INSIGHT FROM COST ACTION CA18213

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Summary

Boosting the entrepreneurial spirit among the youth can transform industries and contribute to social and economic development, ultimately enhancing prosperity in communities and nations, particularly rural areas. This paper, provides a theoretical-conceptual overview of young farmers' entrepreneurship as an insight from COST Action Rural NEET Youth Network: Modeling the risks underlying rural NEETs social exclusion (RNYN). NEETs are those youth who are not in employment, education or training. The multifunctional and diverse nature of rural communities requests a change of rural areas' perception as merely "agricultural dominant," "isolated," and "traditional" in terms of business and policy interventions toward recognizing that rural areas have been and will continue to be vital, if not crucial, in achieving sustainable development and wellbeing for all. To achieve such change, a European Green Deal and associated targeted initiatives offer new avenues for agriculture, rural development, and social innovation. Among many, recommendations include fostering and promoting sustainable economic growth in rural areas, promoting and diffusion of new, modern, and innovative activities (business models). That should be complemented with a better understanding of the alternative marketing channels and the role of Short Food Supply Chains (SFSC) in youth empowerment/engagement, rural female empowerment and rural entrepreneurship, and an understanding of the challenges and obstacles of the young farmers and NEETs and their ability to modernize rural areas. Regardless of the approach, there is no single model for rural development, but common strategies include synergies and networking between local actors, fostering creativity and innovation capacity among the youth with the desired outcome of upholding entrepreneurship potential and activity among the youth.

Keywords: *entrepreneurship, rural to urban continuum, new business models, youth, sustainability*

THE INFLUENCE OF RURAL RESOURCES ON HOUSEHOLD INCOME: A CASE STUDY FROM NORTH MACEDONIA

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Summary

Rural households in North Macedonia rely on a diverse range of resources to sustain their livelihoods. Despite this, rural incomes remain unstable and often insufficient to support long-term economic growth. This study explores the relationship between rural resources and household income, focusing on the role of human, natural, financial, social, and physical assets. Field data was collected from 140 rural households across the Polog and Pelagonija regions in 2018. A multiple linear regression (MLR) model is used to estimate the relationship between household income as a dependent variable and assets as a set of explanatory factors affecting household income and income diversification, including certain natural, physical, human, social and financial resources. Key findings reveal that access to agricultural land and irrigation (natural resources), along with facilities for processing and storage (physical resources), significantly boost household income. Furthermore, human resources such as work experience and informal education, social resources like community network involvement, and financial resources in the form of subsidies also play a critical role in enhancing income levels. However, the study reveals that only a limited number of resources are directly tied to income generation. The results suggest that tailored policy interventions are necessary to maximize the potential of rural resources and improve the socio-economic conditions in these regions.

Keywords: *rural assets, rural income, multiple regression, socio-economic development, Polog and Pelagonija*

ANIMAL PRODUCTION – NEW CHALLENGES

DETERMINATION OF NUTRIENT DIGESTIBILITY OF TOTAL MIXED RATIONS IN THE RUMEN USING *IN VITRO* METHOD

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Summary

The digestibility rate is the most crucial indicator of the utilization of nutrients in the diet of dairy cows. In the artificial rumen, by using in vitro fermentation, it is possible to determine relatively precisely the digestibility of feed for ruminants. This procedure involves incubating a feed sample with liquid rumen under anaerobic conditions. A buffer solution that simulates the composition of saliva in the rumen is used as a medium. Fermentation lasts approximately 48 hours, after which the remaining dry matter, digested cellulose, produced gases, and volatile fatty acids are measured. As material in the experiment, commercial complete rations (TMR) for feeding cows were used, which enables the consumption to be uniform in quantitative and qualitative terms. The idea of the research was to determine the rate and kinetics of digestibility of dry matter and individual nutrient components in samples of commercial TMR (total mixed ration), designed according to the actual production needs of milk production in the first, second and third stages of lactation (Dairy farm PD Butmir, Sarajevo). The results showed significant differences in the physical and chemical composition of the complete mixtures and the same indicators after incubation through eight different time intervals for both dry matter and crude protein, neutral, and acid detergent fibers. This research only confirmed that digestibility analysis with the ANKOM incubator showed enviable results in accuracy, reproducibility, and cost of implementation. Many collaborative and simultaneous studies have shown desirable results despite significant differences in providing biotic and abiotic fermentation factors.

Keywords: *In vitro digestibility, total mixed rations (TMR), lactation, cows*

THE EFFECT OF PHYSICALLY EFFECTIVE FIBERS ON THE DIGESTIBILITY OF TOTAL MIXED RATIONS (TMR) USING DIFFERENT INDICATORS

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Summary

Digestibility rate is an essential parameter of total mixed ration (TMR) quality because forage NDF varies widely in its degradability in the rumen, and digestibility influences animal daily intake and productive performance (Oba and Allen, 1999). In this sense, the physical effectiveness of the meal largely determines the dynamics of decomposition, the kinetics (passage), and, ultimately, the rate of utilization of the ration. The main goal of the research is to evaluate the effect of reducing the particle size of TMR on the total digestibility rate of cows in early lactation according to the Penn State Particle *Separator* (PSPS) measuring method. The diet is based on an *ad libitum* diet of complete mixed meals (TMR) based on corn silage. During the adaptation period, cows were given three different meals (A, B, and C), which were almost identical in chemistry but differed in their content of physically effective fibers (peNDF), distribution, and particle size (6,9 ± 2,4; 5,5 ± 2,3 and 5,4 ± 2,3 mm). The trial was conducted on Dairy Farm Spreča, where the adaptation period lasted 21 days when feces collection was observed. The content of physically effective fibers through meals was 23.5%, 21.8%, and 20.0% at the 4 mm level and 17.5%, 14.0%, and 12.4% at the 8 mm sieve level. The natural, contented indicators lignin (ADL) and acid-insoluble ash (AIA) methods were used to test digestibility. The results showed that physical effectiveness positively influences the digestibility of nutrients except for structural carbohydrates (NDF fiber fraction), which showed a negative correlation.

Keywords: *Digestibility rate, total mixed rations, physical effectiveness of fiber, dairy cows;*

DETECTION OF LAMENESS IN DAIRY COWS USING INFRARED THERMOGRAPHY

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Summary

The diseases of the hoof and lameness in dairy cows is one of the major problems in intensive milk production. These diseases disrupt the welfare of animals, increase the production costs and resulting in large economic losses. Early detection of hoof inflammation in animals is important to prevent lameness. Infrared thermography (IRT) is a non-invasive, non-contact method for recording the temperature distribution on the body surface of animals or other objects. IRT has great potential as an automated diagnostic method for lameness in dairy cows. Interpretation of the thermogram is very important, because the thermogram depends on biological factors of animal, technical and environmental factors. Those are risk factors for implementation and using IRT technologies. Due to the great influence of the environment and the animal itself, it is crusual to ensure adequate conditions at the location of the recording and to consider the influence of the animal itself and its current biological status. It is necessary to have additional support from other lameness detection techniques and data sets that will complement the application of IRT, such as visual hoof observation and behavioural observation methods for dairy cows.

Keywords: *lameness; detection; infrared thermography; dairy cows; risk factors*

IMPACT OF HEAT STRESS ON REPRODUCTIVE PERFORMANCE IN CATTLE: A COMPREHENSIVE REVIEW

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Summary

Heat stress in cattle significantly impacts reproductive performance, physiological health, and overall productivity, particularly during the warmer months. This review examines the multifaceted effects of heat stress on both male and female cattle, focusing on fertility, sperm quality, hormonal imbalances, and behavioral adaptations. Elevated ambient temperatures lead to reduced sperm volume, motility, and viability in bulls, which adversely affects conception rates and subsequent reproductive outcomes. In females, heat stress disrupts estrous cycles, leading to shorter and less intense estrus periods, increased anestrus, and lower fertility rates. Physiologically, heat stress induces hormonal and metabolic changes, such as decreased testosterone levels in males and disrupted progesterone secretion in females, which further compromise reproductive efficiency. Additionally, behavioral responses, such as increased standing time and decreased lying time, indicate an adaptive strategy to enhance heat dissipation, though these behaviors may also contribute to animal discomfort and reduced well-being. Various management strategies, including cooling systems, dietary adjustments, and genetic selection for heat tolerance, are explored as potential mitigative measures. The review underscores the need for continued research and development of effective heat stress management practices to improve cattle welfare and productivity in the face of global warming.

Keywords: *heat stress; cattle fertility; sperm quality; hormonal imbalances; management strategies*

KNOWLEDGE AND APPLICATION OF HORSE LEARNING THEORY

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Summary

The aim is to present an overview of the application of learning theory in practical horse training. Learning theory helps humans understand the learning process, information retention, and creates better communication during work and performances with horses. In the mid-20th century, new insights into the learning processes of animals emerged, leading to the development of a modern approach to horse training. The horse's brain acquires knowledge through non-associative learning (habituation and sensitization) and associative learning (classical conditioning and operant learning). The learning process in horses is influenced by ethology, emotions, mental state, and the environment. Training is subject to the simultaneous use of multiple learning processes, which are sometimes ambiguous, and for successful training, these processes need to complement each other. More research is needed in these areas for the field of equine science to advance and improve the clarity and application of learning processes. Learning theory is an excellent tool for trainers, enabling them to work with horses in a way that facilitates and accelerates learning while maintaining well-being. Training based on learning theory aims to individualize the process, making it essential to give horses time to familiarize themselves with their environment and maintain constant interaction to improve relationships and communication. Optimal use of learning theory should be established as a fundamental principle in working with horses, making it crucial to educate all those involved in horse training. In the 21st century, horses are partners and companions to humans, and their work experience must be mutually enjoyable and beneficial.

Keywords: *learning theory; horse; training*

CHALLENGES OF INTENSIVE MILK PRODUCTION AND GOOD FARM MANAGEMENT

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Summary

Global milk production, as well as the entire dairy industry, has been going through challenging structural and economic changes during the last two decades. According to the annual agricultural report of the United Nations, global milk production in the world from 2021 to 2030 would have an annual growth trend of 1.7% and the number of dairy animals of 1.1%. However, many countries in Europe are recording a decline in the number of cows, farms and even a decline in milk production. Economically strong countries in Europe are trying to find an answer to the coming challenges in the dairy sector in the intensification of production, using modern technological solutions. In doing so, an effort is made to cover all possible levels of breeding and husbandry of dairy cows: from genetics, feeding, husbandry, milking, reproduction, health, and well-being measures. The intensification of the dairy sector should not have an impact on sustainable development. The challenges that this type of production can lead to have an impact on the environment, animal welfare, but also on social, cultural and economic life and even human health.

The aim of this paper was to show how the intensification of milk production can take place without significant damage to animal welfare and with minimal impact on the environment, but with the condition of good farm management. These guidelines could serve today's farmers engaged in intensive milk production in solving the set production goals.

Keywords: *milk, intensive production, welfare, cattle breeding*

FISH POPULATIONS IN FISHING WATERS IN THE AREA OF FOJNICA MUNICIPALITY

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Summary

The ichthyological research in this study aimed to determine the current state of fish populations and to obtain relevant data on the presence of certain fish species in the fishing waters of the Fojnica municipality. The field part of the ichthyological research in the fishing waters of the Fojnica municipality was conducted in October 2019, in the following watercourses: Fojnička River, Željeznica, Radava, Brložnjak, Dragača, Požarna, Borovnica, Hrastinčica, Kozica, Jezernica and Šćona. The fish were caught with a special-purpose electrofishing generator – model "Honda" OHV 5.5 (with a power of 3.0 kW). Collected fish samples were processed on-site, and all individuals were then returned to the watercourse from which they were caught. Systematic fish identification was performed according to Kottelat and Freyhof (2007): Handbook of European Freshwater Fishes; and Vuković and Ivanović (1971): Fishes of Bosnia and Herzegovina. The ichthyological research in the fishing waters of the Fojnica municipality recorded 9 fish species from three families of freshwater ichthyofauna. Systematic determination revealed an equal representation of fish from the families Salmonidae and Cyprinidae, with 4 registered species each (44.44%). The family Cottidae was represented by only one species (11.11%). Based on the analysis of the results from field research conducted at representative localities of the aforementioned watercourses, it can be concluded that the ecological conditions and the quantitative-qualitative composition of ichthyopopulations are at a satisfactory level for all indigenous fish species.

Keywords: *Fojnica, fishing waters, ichthyopopulation, electrofishing, ichthyological research*

INTRODUCTION OF NEW FISH SPECIES IN BORAČKO LAKE OVER THE LAST 20 YEARS

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Summary

Boračko Lake is a natural mountain and glacial lake located at the base of the Prenj mountain, at an elevation of 397 meters. From the ichthyological aspect, this lake was originally of a salmonid character, inhabited exclusively by lake trout. However, over the past few decades, the ichthyofauna of this lake has been significantly changed due to the introduction of other fish species. Ichthyological research conducted at Boračko Lake in 2003, 2011 and 2018 revealed the presence of several new fish species, predominantly cyprinids (fish from the order Cypriniformes). Only a small number of individuals of salmonid fish species were registered. Ichthyological research conducted in 2023 confirmed the presence of several new fish species, which were not registered in earlier research. Today, 11 fish species live in Boračko Lake, among which the most numerous are cyprinids (7 species) and they make up 75.3% of the lake's total ichthyopopulation, while salmonids represent two species with a total share of 6.9%. The rest of the ichthyopopulation of this lake is made up of pike-perch with a share of 14.4%, while the indigenous Neretva spined loach participates with a share of 3.4% of the total ichthyopopulation. In the coming period, a systematic approach is needed to address the issues through selective fishing of allochthonous and invasive fish species in order to preserve, protect and restore the populations of indigenous species.

Keywords: *Boračko Lake, salmonids, cyprinids, introduction, research*

ESTIMATION OF LOCAL ENTERIC METHANE CONVERSION FACTORS IN DAIRY CATTLE USING THE IPCC TIER-2 METHODOLOGY

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Summary

Ruminant production systems generate significant greenhouse gas (GHG) emissions, primarily through methane production from enteric fermentation. The Intergovernmental Panel on Climate Change (IPCC) developed default methane conversion factors (Ym) for different world regions based on neutral detergent fiber (NDF) and digestible energy (DE) content in feed. However, proposed values of methane conversion factors may not represent real-used diets due to significant variability in their composition and feeding practice worldwide. Therefore, the IPCC recommended developing and using local methane conversion factors. The study aimed to assess the feeding practices of dairy cows in Central Bosnia and Herzegovina to create more accurate local methane conversion factors. Various models were used to predict methane emissions from enteric fermentation based on different animal characteristics and the quality of the diets used. The model based on gross energy (GE) intake was quite accurate (RMSPE = 0.010, p=0.015), showing higher Ym values (by up to 8.30%) compared to the IPPC Tier 2 default value, but had a relatively low coefficient of determination (R^2 = 0.286). A more complex model based on dry matter intake (DMI), body weight (BW), and the chemical composition of diets and milk was the most precise, giving Ym values ranging between 6.26 and 8.26, but it is only suitable for milking cows. The model based on the chemical composition of feed and DMI may be acceptable for estimating Ym at the farm level for all classes of animals (R^2=0.929, p=0.000, RMSPE = 0.289), considering both the precision and simplicity of this model.

Keywords: *dairy cows, local methane conversion facors, different models*

PRODUCTION POTENTIAL AND NUMBER OF IMPORTED DAIRY SHEEP BREEDS IN THE REPUBLIC OF CROATIA

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Summary

This paper aims to show the production potential and the number of imported herdbook dairy sheep breeds that are reared in the Republic of Croatia (CRO), as well as the prospects for the development of this production sector. The research included data from research conducted with imported sheep breeds, East Friesian and Lacaune sheep, which are dairy sheep breeds, and Travnik sheep, a combined breed that is also used for milk production in the Republic of Croatia. In the Republic of Croatia, 2521 breeding valued Lacaune sheep, 75 East Friesian sheep, and 263 bred Travnik sheep are reared. An analysis of the number of these breeds revealed an increase in Lacaune sheep and a decrease in East Friesian sheep, while the number of Travnik sheep is standard. The reasons for the above are numerous and include the weaker resistance and more prominent commitment required by the East Frisian sheep, also the increasing depopulation of rural areas, and the lack of labor, where the majority of sheep farming is located in the Republic of Croatia. This gives the Lacaune sheep a considerable advantage, especially in the continental regions of the Republic of Croatia, rich in fodder. The development of the dairy sector in sheep farming has good prospects in the Republic of Croatia, considering that the demand for sheep's milk has increased, which is accompanied by an increased interest in the purchase of Lacaune sheep, but also that the results of research conducted so far in the Republic of Croatia with Lacaune sheep indicate a high milk yield and good milk quality and adaptability.

Keywords: *dairy imported breeds, sheep, production potential, population size, Republic of Croatia*

MICROBIOLOGICAL ANALYSIS OF WELL WATER

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Summary

Water is an essential component in food production, and for its safe use, it must possess satisfactory physical and chemical properties and be free of certain microorganisms. Inadequate management of wastewater leads to the contamination of drinking water sources, introducing undesirable inorganic and organic substances, along with numerous microorganisms that pose health risks to humans and animals. Analyzing bacteria from wells is vital for ensuring the safety of drinking water. Wells, being primary water sources in many rural and peri-urban areas, are often susceptible to contamination by various bacteria due to environmental interactions. This contamination can result in numerous health issues, including gastrointestinal diseases.This study aims to conduct a microbiological analysis of well water used on animal farms. Four wells located in the municipalities of Vareš, Vogošća, Breza, and Visoko were analyzed. The microbiological analysis assessed the total bacterial count and the total number of coliform bacteria. Most samples revealed the presence of coliform bacteria. The results indicate that the wells are insufficiently protected from external contamination, allowing the infiltration of contaminating substances into the wells, rendering the water unsafe for use.

Keywords: *well water, coliform bacteria, fecal contamination, water microbiology*

THE EFFECTS OF FISH FARMS ON THE ECOLOGICAL STATE OF THE LJUTA RIVER

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Summary

The river Ljuta is a right tributary of the river Neretva, which rises on the slopes of Visočica and Bitovnja, with a length of 4-5 km. Two salmonid fish farms have been installed on the river. The concrete pond "Riba Neretva Konjic" on the Ljuta watercourse was installed in 1974, at coordinates 43°38'27.56" N 18°00'54.96" E and 333 m above sea level. The pond includes a hatchery, growing area and fattening area, in this regard the installed area is 12,500 m^2, and the volume of affected water is 14,600 m^3. Our research (2008-2019) in this area indicates degradation downstream from the first fish farm, with a large increase in non-native organic matter (pond waste water) and BOD_5 (3.84 mg/l), and increase in saprobity based on phytobenthos and macrozoobenthos analysis. The biggest pressure of pollution on this water body originates from the fish farm "Riba Neretva Konjic" (TP 1,714.6 kg/year). According to the Adriatic Sea water area management plan, this watercourse is classified as type 10a (Small and medium-sized mountain streams on a carbonate substrate), and according to the values of NH_4, TP, the limit values for a certain good ecological condition are recorded. High values of TP were also measured in the sludge downstream from the fish farm, which is an effect from the fish farm. Threshold values for a good ecological status of this water body were also calculated for selected metrics for phytobenthos and macrozoobenthos composition, and degradation was recorded for the research site on the Ljuta river downstream from the pond.

Keywords: *aquaculture, degradation, saprobity, survey, foreign species*

METABOLIC RESPONSES TO INTERMITTENT FASTING: INSIGHTS FROM TIME-RESTRICTED FEEDING AND MODIFIED FASTING APPROACHES

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Summary

This study investigates the effects of intermittent fasting on metabolic health, specifically focusing on weight management, glucose, triglycerides, and cholesterol levels. The research explores two intermittent fasting methods: modified fasting regimens with curcumin supplementation (5:2) and time-restricted feeding (16/8) over three weeks. Participants were divided into three groups: (A) a control group with no dietary intervention, (B) a group following the 5:2 modified fasting regimen combined with curcumin supplementation, and (C) a group following the 16/8 time-restricted feeding method.

Body weight and blood samples were collected to assess metabolic parameters, including glucose, triglycerides, and cholesterol levels. The data were processed using principal component analysis (PCA). Participants also completed questionnaires assessing the psychological effects of the fasting methods.

While the study found no significant changes in overall metabolic parameters across the groups, the time-restricted feeding group (C) showed noticeable improvements in weight management and LDL cholesterol levels compared to the modified fasting regimen group (B). These findings suggest that while intermittent fasting may not produce dramatic short-term metabolic improvements, specific methods like time-restricted feeding may offer promising benefits for managing weight and lipid profiles. The study's implications are significant, as it opens avenues for further exploration of intermittent fasting as a long-term health optimization strategy.

Keywords: *intermittent fasting, energy restriction, metabolism, weight, glucose*.

ANALYSIS OF THE IMPACT OF TEMPERATURE-HUMIDITY INDEX ON THE CHEMICAL PARAMETERS OF RAW MILK IN VARIABLE CLIMATIC CONDITIONS: A CASE STUDY OF FARM "TOMISLAVGRAD" (2014–2024)

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Summary

This study examines the influence of the Temperature-Humidity Index (THI) on the chemical composition of raw milk from January 2014 to January 2024 at the farm "Tomislavgrad" in Tomislavgrad. The objective was to determine how changes in THI values affect the primary chemical parameters of milk, including milk fat, proteins, lactose, total solids, somatic cell count (SCC), and urea. Data were analyzed using Pearson's correlation coefficient to establish the relationship between THI and each individual chemical parameter of milk. The results revealed the following correlation coefficients: milk fat -0.10 (weak negative correlation), proteins 0.48 (moderate positive correlation), lactose -0.09 (very weak negative correlation), total solids -0.21 (weak negative correlation), DM (dry matter) 0.44 (moderate positive correlation), SCC (somatic cells count) 0.33 (moderate positive correlation), and urea 0.46 (moderate positive correlation). The findings indicate that an increase in THI is moderately positively associated with increases in protein content, somatic cell count, dry matter in raw milk, and urea, suggesting that higher THI may adversely affect the health of livestock and the quality of milk. Conversely, the correlation between THI and milk fat, lactose, and total solids shows a minor or very weak negative link, indicating a lesser impact of heat stress on these parameters. The conclusions of the study emphasize the need to implement measures to reduce heat stress in cows, particularly during periods of high THI values, to preserve milk quality and livestock health on farms.

Keywords: *Temperature-Humidity Index; raw milk; chemical composition; heat stress; dairy cattle*

NEW FRONTIERS IN PLANT HEALTH

ANTIOXIDANT PROPERTIES OF FIVE SELECTED GREENHOUSE-GROWN AROMATIC PLANTS

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Summary

The present study was designed to analyse the antioxidant chemical constituents (total phenolic and total flavonoid contents) and total antioxidant activities of five selected greenhouse-grown aromatic plants, namely coriander (*Coriandrum sativum* L.), dill (*Anethum graveolens* L.), lemon balm (*Melissa officinalis* L.), basil (*Ocimum basilicum* L.) and fennel (*Foeniculum vulgare* L.). The experiment was carried out from end-May to mid-August 2024 under greenhouse conditions at the experimental station of the Faculty of Agriculture and Food Sciences in Sarajevo. Total phenolic and flavonoid contents in the leaf extracts were determined by Folin-Ciocalteu and $AlCl_3$ assay respectively, whereas total antioxidant activities were estimated using ferric reducing antioxidant power (FRAP) assay. The total phenolic content expressed as mg gallic acid equivalent per 100 g fresh weight (GAE /100 g FW) was found to be highest in the lemon balm (182.2 ± 36.7 mg GAE/100 g FW) followed by basil (70.9 ± 7.3 mg GAE/100 g FW), fennel (66.8 ± 3.3 mg GAE/100 g FW), dill (64.9 ± 3.2 mg GAE/100 g FW) and coriander (55.2 ± 8.6 mg GAE/100 g FW). The total flavonoid contents and total antioxidant activity values follow the same order as that of total phenolic content in the extracts respectively. All tested plant extracts showed a strong correlation between the phenolic content and their antioxidant activities.

Keywords: *phenolic compounds, flavonoids, lemon balm*

HEALTH RISK ASSESSMENT OF HEAVY METALS IN BASIL (*OCIMUM BASILICUM* L.) GROWN IN ARTIFICIALLY CONTAMINATED SUBSTRATES

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Summary

Medicinal plants have been used as therapeutic agents since ancient times. However, consumer concerns regarding the safety of their use have been growing in recent years, mainly due to the continuous increase of environmental pollution. Heavy metals, such as Cr, Cd, and Pb can cause adverse effects on human health even in small quantities and therefore represent a category of pollutants of particular interest for health risk studies. This study aimed to determine the levels of Cd, Cr, and Pb in different parts of basil (*Ocimum basilicum* L.) cultivated on artificially contaminated substrates and to assess their potential harmful effects on human health via the calculation of the target hazard quotients (THQ). A pot experiment was performed in a completely randomized design for each tested heavy metal. It included four contamination treatments (0, 20, 50, and 100 mg kg^{-1} for Cd, and 0, 100, 250, and 500 mg kg^{-1} for Pb and Cr) with three replications per treatment. Concentrations of Cd, Cr, and Pb in plant samples are determined by atomic absorption spectroscopy (AAS) using the Shimadzu AA7000 device. The results of this study showed that the Cd, Cr, and Pb concentrations were several times higher in the roots than in the above-ground parts of basil regardless of contamination levels, suggesting that basil possesses very effective mechanisms to prevent their transport from roots to other parts of plants. These are desirable results because only above ground parts of basil are used for medicinal purposes or consumption. The THQ values for Cd, Cr, and Pb observed in this study were lower than 1 regardless of contamination levels, indicating that the consumption of basil from the study site (up to 10 g per day) does not pose a risk to human health from the point of view of heavy metal investigated.

Keywords: *cadmium, chromium, health, lead, pollution*

CONTROL OF CODLING MOTH (*CYDIA POMONELLA* L.) BY APPLICATION OF INSECTICIDE CHLORANTRANILIPROLE

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Summary

In the last few decades, intensive apple farming has required increasing technology and knowledge to ensure a high yield and product quality. Pest and disease management in apple orchards, in addition to various control tools such as agrotechnical and biological protection measures, includes different chemical pesticides for plant protection several times during the year. The codling moth (Cydia pomonella) is one of the most important orchard pests, particularly in apples, causing serious damage, resulting in premature fruit drop, and difficulties preserving fruit during storage, primarily due to untimely and unsuitable protection. This study aimed to assess the efficacy of plant protection product based on chlorantraniliprole (200 g a.i./L, SC) in the control of the codling moth in apple orchards. The trials were carried out in 2023 and 2024, in the apple orchard (variety Idared, Golden Delicious and Gala) at Budisava and Mala Remeta localities (Vojvodina, Serbia), according to the standard EPPO methods. The products were foliar applied at a concentration of 0.02%, using a backpack sprayer. The experiment was set up in four replications in randomized block design. By visual examination, the presence of C. pomonella eggs and the hatching of caterpillars of the first (2023) and second (2024) generations was registered. The efficacy of the tested insecticide was evaluated based on the number of damaged fruits. The efficacy of the insecticide was calculated according to Abbott and to the significance of differences (ANOVA) for the confidence interval of 95%. In 2023, fourteen days after application the efficacy of chlorantraniliprole was 95.3% at the locality Budisava, while in locality M. Remeta efficacy was 92.4%. After 22 days, the product showed good efficacy, ranging from 88.2-93.0%, depending on the locality. In 2024, 14 days after the application the efficacy was 93.7% and 89.8%, at the locality Budisava and M. Remeta, respectively. Finally, 25 days after the treatment, the insecticide showed good efficacy (89.5-90.6%). In both years, the number of damaged apples in the variants where applied chlorantraniliprole was significantly lower, compared to the control. This study showed that C. pomonella expressed notable susceptibility to chlorantraniliprole, indicating that this insecticide can still be effectively used for managing this economically significant pest in apple orchards, as long as the anti-resistance strategy is strictly adhered to.

Keywords: *apple, Cydia pomonella, chlorantraniliprole, efficacy.*

PSEUDOMONAS SPECIES CAUSING DISEASES IN ALFALFA

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Summary

The *Pseudomonas* genus contains species that are important pathogens causing significant plant losses. Many of these pathogens lead to diseases that have global economic and environmental impacts on plant, seed, and food trade. Alfalfa (*Medicago sativa*) is one of the most widely grown and important forage crops globally. Its outstanding characteristics, such as high biomass yield, excellent forage quality, and preference by ruminants, set it apart from other forage crops and earned it the nickname 'Forage Queen'. However, certain phytopathogenic *Pseudomonas* species can result in substantial yield losses in alfalfa production. This review discusses the diseases caused by *Pseudomonas* species in alfalfa, their symptoms, and the disease-causing mechanisms of the pathogens. It also covers techniques for detecting and isolating these species from plants and soil, as well as methods for controlling these diseases. This review aims to provide researchers with comprehensive scientific information on managing *Pseudomonas*-related diseases in alfalfa production.

Keywords: *Pseudomonas spp., alfalfa, disease control*

RASPBERRY LEAF BLOTCH EMARAVIRUS – A SIGNIFICANT THREAT TO RASPBERRY PRODUCTION

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Summary

Raspberry leaf blotch emaravirus (RLBV) is a recently characterized virus infecting raspberries. RLBV has been reported in numerous European countries, and it is vectored by the raspberry leaf and bud mite (*Phyllocoptes gracillis*). Virus infection is manifested by light green and yellow leaf blotches and patches, leaf twisting, and distortion of leaf margins. RLBV is the most important virus infecting raspberries in Serbia, causing severe leaf symptoms, including cultivar 'Willamette' that is dominant in the orchards, with a share of about 90%.

Results of the conducted research in the last decade confirmed wide distribution and significant genetic diversity of RLBV in Serbia. It was detected in all raspberry-growing regions in all tested cultivars. The fruit of the raspberry 'Willamette' proved to be significantly affected by RLBV infection. Depending on the locality and altitude, the recorded reduction of fruit weight was up to 27%. On the other side, soluble solids content in infected fruits was higher. The results of the study on the changes in chemical composition of 'Willamette' fruits confirmed the influence of RLBV infection on the examined phenolic profile, but this influence was quite minor compared to the influence of soil composition and weather conditions.

Available research data suggest that climate change will have strong effects on plant viruses and their epidemiology that can lead to an increase in their host range and severity.

Keywords: *Rubus idaeus L., RLBV, fruit, diversity, yield*

ALLELOPATHIC POTENTIAL OF RAGWEED (*Ambrosia artemisiifolia* L.) AS AN INVASIVE WEED SPECIES

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Summary

Plant species that, due to their rapid and dense growth and spread, have a negative impact on biodiversity, human health, and cause economic damage to the areas where they were introduced are called invasive alien species (IAS). The behavior of invasive weed species in new plant communities researchers associate with their allelopathic activity. An invasive species, introduced in a new plant community, acts with its allelochemicals on autochthonous species that do not have adaptive potential to new compounds originating from foreign plant species. The aim of this work was to examine the allelopathic potential of ragweed (*Ambrosia artemisiifolia* L.). This species is on the DAISIE and EPPO lists of invasive foreign species. Available data on the allelopathic potential of ragweed were taken from scientific databases using terms such as: "*Ambrosia artemisiifolia* allelopathy," "*Ambrosia artemisiifolia* allelopathic potential," "allelopathy of invasive weeds." Analysis of numerous scientific and professional papers showed the possession of strong allelopathic activity of this invasive weed species.

Keywords: *ragweed, invasive species, weeds, allelopathy*

ALLELOPATHIC POTENTIAL OF BASIL VOLATILE COMPONENTS

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Summary

Weeds are considered unwanted plants that have always been one of the major challenges in agriculture. The long-term struggle against these plants has led to a range of other problems such as resistance and environmental pollution. In view of the above problems, there has been a shift towards consideration of the allelopathic phenomenon and the possible use of natural plant components as a solution to these challenges. Therefore, essential oils and their main components are increasingly recognized as potential weed control agents due to their favorable toxicological and ecotoxicological properties. The aim of this work was to investigate the allelopathic potential of the essential oil volatile components of basil. Lettuce was used as an indicator species. Essential oil was applied in various doses (0, 1, 2, 3, 4 and 5 µl) using the cotton swab method. Inhibition of initial growth parameters of the indicator species was recorded at higher doses of basil oil (3, 4 and 5 µl), while lower doses showed fluctuations throughout the study. GC-MS analysis of basil oil revealed that linalool and α-bergamotene are dominant component, along with other important terpenes. According to the obtained results, this work opens new perspectives for further analysis and utilization of the main components of basil essential oil in the synthesis of new biological agents for weed control.

Keywords: *allelopathy, volatile components, basil, inhibition, linalool, α-bergamotene*

BOTRYTIS BLIGHT OF BLUEBERRY IN BOSNIA AND HERZEGOVINA

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Summary

In June 2022, blight symptoms were observed in young blueberry plants (cv. Bluecrop) in a blueberry plantation in Bihać, Bosnia and Herzegovina. The symptoms included blackened young shoots, affecting approximately 5% of the plants. After conducting cultural, morphological, and molecular analyses, the causal fungus was identified as *Botrytis cinerea*. Pathogenicity studies, carried out in a greenhouse using 2-year-old blueberry plants (cv. Bluecrop), confirmed the pathogenicity of *B. cinerea*. This is the first reported case of *Botrytis cinerea* causing blight disease in blueberries in Bosnia and Herzegovina.

Keywords: *Botrytis cinerea, blueberry, Bosnia and Herzegovina*

PREVALENCE OF OAT STEM RUST IN SOME PROVINCES OF TÜRKİYE

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Summary

One of the most damaging diseases in oats is oat stem rust, caused by *Puccinia graminis* f. sp. *avenae*. It is especially problematic in regions with relatively low temperatures and high humidity, where oats are grown. *Puccinia graminis* f. sp. *avenae* significantly reduces yield and quality by reducing the photosynthetic area in oat plants. In 2023, surveys were conducted in the oat planting areas in Bolu, Afyonkarahisar, Kastamonu, Çankırı, Edirne, Osmaniye, Adana, Mersin, Kahramanmaraş, Gaziantep and Hatay provinces of Türkiye in May, June and July. The prevalence of oat stem rust disease was determined as 25% in Bolu and Afyonkarahisar provinces, 50% in Edirne province, 48% in Kastamonu province, and 17% in Çankırı province. Oat stem rust disease was not encountered in the surveys conducted in Osmaniye, Adana, Mersin, Kahramanmaraş, Gaziantep, and Hatay provinces.

This study was supported by the Ministry of Agriculture and Forestry General Directorate of Agricultural Research and Policies, Türkiye (Project No: TAGEM/BSAD/Ü/22/A2/P1/5175).

Keywords: *Oat, Oat stem rust, Puccinia graminis f. sp. avenae, Türkiye*

DIRECT EXAMINATION OF THE EFFECT OF HERBICIDES ON THE GROWTH OF PLANT GROWTH PROMOTING BACTERIA

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Summary

Fertile soils are extremely important for crop production as they contain nutrients that are essential for plant growth, fruit formation and grazing by domestic animals. Microorganisms (PGPR) found in the rhizosphere are largely responsible for soil fertility. PGPR (Plant Growth Promoting Rhizobacteria) are microorganisms that have the ability to stimulate plant growth, inhibit growth and slow or stop the growth of certain microbes. Previous research has shown that the use of PGPR bacteria reduces the possibility of soil and groundwater toxicity (soil and water purification), increases soil organic matter content (humification and dehumidification), increases the number and activity of microorganisms in the rhizosphere of cultivated plants and saves the amount of pure nitrogen. In our research, the effects of three herbicides (Siran, Agrodimark, Lumax) on PGPR microorganisms such as: *Bacillus mycoides, Pseudomonas fluorescens* and species of the genus *Azotobacter* sp. were examined. Inhibitory, stimulatory and neutral effects on the growth of the tested microorganisms were found.

Keywords: *herbicide, PGPR, Bacillus mycoides, Pseudomonas fluorescens, Azotobacter sp.*

COMPARATIVE ANALYSIS OF THE INFLUENCE OF CERTAIN HERBICIDES ON THE GROWTH OF NODLE BACTERIA OF THE GENUS *RHIZOBIUM SP.*

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Summary

Bacteria of the genus *Rhizobium* sp. have the task of fixing nitrogen by forming nodules on the roots of legumes in which nitrogen-fixing bacteria live. The use of herbicides poses a potential threat to the activity of soil microbes. The effect of herbicides on the growth of nodule bacteria depends on the type of herbicide and the dose applied: Lumax, Siran 40 SC and Agrodimark affect the growth of nodule bacteria of the genus Rhizobium sp. isolated from alfalfa (*Medicago sativa* L.), white clover (*Trifolium repens* L.) and red clover (*Trifolium pratense* L.). The method used was the test disc diffusion method, with which the results were obtained. The herbicide Lumax showed a weak inhibitory effect on *Rhizobium meliloti* (isolated from alfalfa) and *Rhizobium trifolii* (isolated from white clover) at the recommended dose, but a slight inhibitory effect on *Rhizobium meliloti* and a strong inhibitory effect on *Rhizobium trifolii* (isolated from red clover) at twice the recommended dose. The herbicide Siran 40 SC showed a weak inhibitory effect on *Rhizobium meliloti* and *Rhizobium trifolii* at both doses, while at a double dose *Rhizobium melilotii* (isolated from red clover) and *Rhizobium trifolii* (isolated from alfalfa) showed a strong inhibitory effect. The herbicide Agrodimark showed a good inhibitory effect on *Rhizobium meliloti* (isolated from alfalfa) and *Rhizobium trifolii* at the recommended application dose, while at a double dose it showed a good inhibitory effect on *Rhizobium trofolii* (isolated from red clover).

Keywords: *herbicides, Rhizobium sp., test diffusion method*