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PLANT PRODUCTION

PLANT PRODUCTION

EFFECT OF N APPLICATION AND GROWTH REGULATOR ON SEED PRODUCTION OF TETRAPLOID ITALIAN RYEGRASS

Simić A.[1], Jovanović-Radovanov K.[1], Mandić V.[2], Bijelić Z.[2], Sokolović D.[3], Babić S.[3]

[1]Faculty of Agriculture, University of Belgrade, Zemun-Belgrade, Serbia
[2]Institute for Animal Husbandry, Zemun, Belgrade, Serbia
[3]Institute for Forage Crops, Globoder, Kruševac, Serbia

Summary

Italian ryegrass is an important short duration grass in Serbia. The Serbian production of forage and grass seed are often in areas characterized by seasonally very variable conditions. Also, nitrogen (N) spring application maximizes grass seed production, but influence the incidence and severity of lodging. Therefore, we analyzed the effect of different N rates (0,50 and 100 kg ha^{-1}) in spring and growth regulator trinexapac-ethyl (TE) doses (0, 0.5 L ha^{-1} and 1 L ha^{-1} (Moddus 250-EC)) in 2018 and 2019, on morphological parameters of Italian ryegrass (Lolium multiflorum Lam) tetraploid cultivar K-29 in first production years. Before swathing, internodes length, stem length, spike length and the number of spikelet from 10 randomly picked tillers per plot were measured. The increase of N rate significantly increased the fifth and sixth internodes length in first year. Also, significant decrease of internodes length was achieved in cv. K-29 with 1 L ha^{-1} TE. TE decreases length with both doses of TE. The use of higher N fertilizer rates together with TE in Italian ryegrass seed crop can be valuable practice for tetraploid cultivars.

Key words: growth regulator, Italian ryegrass, nitrogen application, seed production

DETERMINATION OF YIELD AND AGRONOMIC CHARACTERISTICS OF SOME SOYBEAN GENOTYPES SUITABLE FOR DOUBLE CROP AGRICULTURE IN MEDITERRANEAN CLIMATE CONDITIONS

Yildirim A., Yildiz H., Ilker E., Ekren S.

Ege University, Faculty of Agriculture, Department of Field Crops, Izmir, TURKEY

Summary

As a source of oil, protein, biodiesel, etc., soybean (*Glycine max L. Merr*.) is the fourth widely grown crop in the world. In Mediterranean climate conditions, soybean can be produced as a double crop. This study was conducted at thev experimental area of Department of Field Crops, Faculty of Agriculture, Ege University in Turkey (2016) to determine yield and important agronomic traits of some soybean varieties and lines under double crop conditions. Ten advanced soybean lines and four registered varieties (KASM-03, KASM-02, KANA, KAMA, BDUS-04, BATEM 207, BATEM 223, BATEM 306, BATEM 317, BDSA 05 and ARISOY, ATAEM-7, BRAVO, NOVA) were used as a plant material. Field trials were conducted in a randomized complete block design (RCBD) with four replications. Results from the analysis of variance for all traits (grain yield, plant height, first pod height, pods per plant, days for maturity, days for flowering, 100-seed weight) indicated large variations among the genotypes. Although the lines KASM-02 (3519.5 kg ha^{-1}), BATEM 207 (3456.7 kg ha^{-1}) and BATEM 223 (3414.2 kg ha^{-1}) provided the best result for grain yield, according to earliness, ARISOY, ATAEM-7 and BRAVO registered varieties were showed better performance rather than advanced lines used in the study. As a result, these promising advanced lines should also be tested in main crop conditions for Mediterranean climate.

Key words: soybean, double cropping, yield, earliness

DETERMINATION OF THE BARLEY DISEASES IN BINGÖL PROVINCE OF TURKEY

Saraç Sivrikaya I.[1], Karakaya A.[2], Çelik Oğuz A.[2]

[1]Bingöl University, Faculty of Agriculture, Department of Plant Protection, Merkez, Bingöl, 12000, Turkey
[2]Ankara University, Faculty of Agriculture, Department of Plant Protection, Dışkapı, Ankara, 06110, Turkey

Summary

Five barley fields in Genç, Adaklı and Central district of Bingöl province of Turkey were investigated for the presence of barley diseases in 2018. Spot form of net blotch caused by *Drechslera teres f. maculata*, net form of net blotch caused by Drechslera teres f. teres, scald caused by Rhynchosporium commune, powdery mildew caused by *Erysiphe graminis f. sp. hordei*, barley stripe caused by *Drechslera graminea* and covered smut caused by *Ustilago hordei* were found among the fields inspected. Prevalence and severity of these diseases showed variation.

Keywords: Barley diseases, Bingöl, Turkey

EX-SITU REMEDIATION OF HEAVY METALS CONTAMINATED SOILS USING NATURAL ALUMINOSILICATE MINERALS

Sijahović E.[1], Čivić H.[1], Murtić S.[2]

[1]University of Sarajevo, Faculty of Agriculture and Food Science, Department of Plant Nutrition, Bosnia and Herzegovina
[2]University of Sarajevo, Faculty of Agriculture and Food Science, Department of Plant Physiology, Bosnia and Herzegovina

Summary

The effects of zeolite and pyrophyllite on decreasing heavy metals availability in contaminated soil were evaluated in pot experiments. The zeolite and pyrophyllite materials were added to contaminated soil at four rates i.e. 0, 200, 400 and 600 kg ha^{-1}. The available forms of heavy metals from soil samples were extracted using EDTA solution (0.01 mol dm^{-3} $C_{10}H_{16}N_2O_8$ and 1 mol dm^{-3} $(NH_4)_2CO_3$, adjusted to pH 8.6) and their concentrations in the obtained extract were determined using atomic absorption spectrophotometry.
Zeolite and pyrophyllite incorporation in soil was found to reduce the availability of heavy metals in soil under experimental conditions. The addition of zeolite was more effective in decreasing Cu and Pb availability, while the pyrophyllite showed a better effect on reducing Mn and Cd availability. These results indicated that addition of these clay minerals could be a suitable technique for heavy metals removal from soils. However, the further research is necessary to confirm this hypothesis across different experimentation and soil ecosystems.

Keywords: availability, pyrophyllite, zeolite

THE POTENTIAL OF TRITICALE (X TRITICOSECALE) FORAGE AS A SOURCE OF ANIMAL FEED

Geren H., Tuncer Kavut Y.

Ege University, Faculty of Agriculture, Department of Field Crops, Izmir, Turkey

Summary

Field trials were conducted in 2014-2016 at the Ege University, Faculty of Agriculture, Department of Field Crops in Izmir-Turkey, to evaluate the forage and silage performance of triticale cultivars under rain fed conditions. Five different triticale cultivars (Ege Yıldızı, BDMT06, Karma, Tatlıcak-97 and Focus) were used as crop material. The crops were cut at milky-dough stages. Some traits were tested in the experiment such as dry matter (DM) yield, silage pH, contents of lactic acid, crude protein (CP), neutral detergent fibre (NDF) and acid detergent fibre (ADF). Results indicated that there were significant differences among the cultivars in terms of DM yields and silage quality. The year effect was also significant on all tested parameters in the experiment. Ege Yıldızı cv produced significantly higher DM yield (12.85 t $ha^{-1)}$ than the other triticale cultivars. Significant differences in CP content of silage (9.9-10.5%) were observed. Differences in ADF and NDF suggest that genotype selection in triticale for silage production should be based on quality in addition to yield. Based on these findings, Ege Yıldızı cv of triticale can be recommended for forage and silage production for the coastal part of Izmir region.

Keywords: triticale, cultivars, DM yield, silage.

PHENOLOGY OF SOME WALNUT GENOTYPES AND CULTIVARS IN YALOVA (TURKEY) ECOLOGY

Orman E.[1], Hepaksoy S.[2]

[1] Atatürk Central Horticultural Research Institute Yalova, Turkey
[2]Ege University, Faculty of Agriculture, Department of Horticulture, Izmir, Turkey

Summary

Variation in the phenology of plants is one of the most sensitive ecological responses to climate change. Changes to species' phenology can have a wide range of impacts on ecological processes, agriculture and forestry. Early bud-break is a limiting factor for commercial walnut growing like other species. Frequent late-Spring frosts may damage flowers, buds, or nuts at the beginning of their development. For this reason it is very important to know phenology of cultivars. In this study, we determined phenology of 30 walnut genotypes and cultivars which are grown under same ecological conditions.
Date of terminal bud burst differed between mid-march and April. The earliest burst of male flowers date was April 5 while the latest date was May 1. First female bloom of walnut genotypes/cultivars changed between April 7 and May 10. We observed that most of genotypes had protandry In general fruit maturation occurred in the second part of September. Leaf drop started November 9 and finished December 15.

Key words: Walnut, Juglans regia, cultivar, phenology, flowering

THE EFFECTS OF IRRIGATION ON LEAF CHLOROPHYLL CONTENT OF POMEGRANATE CULTIVARS

Bahaulddin A.[1], Hepaksoy S.[2]

[1]Kirkuk University, Faculty of Agriculture, Department of Horticulture, Kirkuk, Iraq
[2]Ege University, Faculty of Agriculture, Department of Horticulture, Izmir, Turkey

Summary

Pomegranate (*Punica granatum* L.) is a characteristic species of the Mediterranean area whose use and culture have longstanding tradition. It is well adapted to the growth conditions in Turkey and Mediterranean countries and is frequently found growing in wild or semi wild conditions. It is an important horticultural crop for both domestic and export markets in Turkey. Pomegranates can tolerate long periods of drought once the plant is established but regular irrigation is mandatory in commercial production. In this research the effect of different irrigation on content of leaf pigments of four different pomegranate cultivars was determined. Three water amounts (0, 50 and 100% of estimated evapotranspiration by considering class A pan evaporation) were applied by drip irrigation system. First leaf samples were taken a week before starting the irrigation treatments and continued until the end of the harvest season with four weeks interval and they were taken five times. Results showed that all chlorophyll components (a, b and total) were affected by the water and they were higher in the irrigated trees than non-irrigated trees.

Key words: Pomegranate, Punica granatum, drought stress, chlorophyll a, chlorophyll b.

PHENOLOGICAL CHARACTERISTICS OF INTRODUCED ALMOND (PRUNUS AMYGDALUS) CULTIVARS IN HERZEGOVINA

Hasanbegović J.[1], Hadžiabulić S.[1], Kurtović M.[2], Gaši F.[2], Skender A.[3], Grahić J.[2]

[1]University Džemal Bijedić of Mostar, Agromediterranean Faculty, Bosnia and Herzegovina

[2]University of Sarajevo, Faculty of Agriculture and Food Sciences, Bosnia and Herzegovina

[3]University of Bihać, Biotechnical faculty, Bosnia and Herzegovina

Summary

This study aims to determine some phenological characteristics of the seven main introduced cultivars of almond (Ferragnes, Ferraduel, Tuono, Genco, Supernova, Texas, Nonpareil), in the area of Herzegovina, a part of privately owned orchard located near the village of Gnojnice, Municipality of Mostar.

The area of Herzegovina - Mostar is very favorable for intensive growing of almonds. Consequently, flowering period was studied for two years (2017-2018). Phenological observations are considered to be sensitive tools for identifying of plant responses to climatic changes.

Flowering period is an important agronomic trait for almond since it is decisive to avoid the late frosts that affect production in early flowering cultivars. Evaluation of this complex trait is a long process. Almonds are flowering very early, in early spring, so this often results in damages by late frost as well as a low pollination and fruit set during cold, cloudy and rainy weather. Late flowering is the aim of the most of almond breeding programmes, because of a reduced possibility of spring frost and temperatures that are more favorable for pollination and fruit set.

Flowering order of almond cultivars studied in this research was uniformed through years, and it was as follows: “Tuono“ - “Texas“ - “Ferragnes “ - “Nonpareil“ - “Ferraduel“ - “Genco“ - “Supernova“.

Based upon observation of flowering period, it has been concluded that all the almond cultivars belong to the group of medium late flowering, showing satisfying adaptation to ecological conditions of Herzegovina. There were significant differences in the time beginning of ripening of almond cultivars in 2017 and 2018, which is a result of agro-ecological conditions. Studied cultivars by the ripening time, belong to the groups of medium late cultivars.

Keywords: Prunus amygdalus, Almond, Flowering Phenophases, Ripening, Ecological Conditions

SOIL WATER BALANCE RESPONSE TO CLIMATE CHANGE IN POSAVINA REGION

Čadro S.[1], Marković M.[2], Kaloper S.[1], Ravlić M.[2], Žurovec J.[1]

[1]University of Sarajevo, Faculty of Agriculture and Food Sciences, Sarajevo, Bosnia and Herzegovina
[2]Josip Juraj Strossmayer University of Osijek, Faculty of Agrobiotechnical Sciences, Osijek, Croatia

Summary

Posavina region represents the area with the most favorable natural conditions for agricultural production in Croatia and Bosnia and Herzegovina. Increase in the air temperature and changes in the amount of rainfall results in changes in evapotranspiration and the values of main water balance elements indicating the need for a precise determination of the current and future state of basic water balance elements, such as soil moisture deficit and the amount of runoff. Linear regression was applied to determine soil water balance response to climate change in Posavina region. The air temperature, precipitation, reference evapotranspiration and water balance components: actual evapotranspiration, total runoff, soil moisture deficit and amount of snow trends were analyzed. Monthly weather data from 4 weather stations, two in Croatia: Slavonski Brod and Gradište; and two in Bosnia and Herzegovina: Doboj and Gradačac, for the time period of 58 years (1961 – 2018) were used. The results obtained show increasing trends in annual air temperature (0.032 ^{0}C - 0.057 ^{0}C year^{-1}), sum of precipitation (1.424 mm - 2.317 mm year^{-1}), reference evapotranspiration (0.462 mm – 4.640 mm year^{-1}), actual evapotranspiration (0.019 mm – 2.190 mm year^{-1}), soil moisture deficit (0.443 mm – 2.672 mm year^{-1}) and total runoff (0.286 - 2.469 mm year^{-1}) series and decreasing trend in the annual amount of snow (-0.676 - 1.664 mm year^{-1}). Results obtained are showing an urgent need to start with climate change adaptation measures and actions to combat the negative impact of climate change in the Posavina region

Keywords: Water balance, Climate Change, Posavina region, Sava river

OPINIONS OF CITIZENS OF SARAJEVO ON THE USE OF INVASIVE ALIEN PLANT SPECIES IN HORTICULTURE

Avdić J.[1], Sarajlić N.[2], Bečić B.[3], Murtić S.[1], Turalija A.[4]

[1]University of Sarajevo, Faculty of Agricultural and Food Sciences, Sarajevo, Bosnia and Herzegovina
[2]University of Niš, Faculty of Science and Mathematics, Niš, Serbia
[3]National Museum of Bosnia and Herzegovina, Sarajevo, Bosnia and Herzegovina
[4]Faculty of Agriculture in Osijek, Osijek, Croatia

Summary

A large number of invasive plant species, which pose a significant threat to biodiversity today, were introduced in gardens and parks because of their ornamental properties. In the spontaneous flora of the city of Sarajevo, 82 alien plant species have been recorded so far, of which a significant number is present in backyards, gardens and green areas around residential buildings maintained by the tenants, and it is obvious that they have been deliberately planted there. This paper presents the results of the survey of 150 citizens of Sarajevo on the perception of horticultural characteristics of invasive alien plant species *Artemisia annua* L., *Helianthus tuberosus* L., *Impatiens balfourii* Hook f., *Oenothera biennis* L. and *Solidago gigantea* Aiton.

Key words: invasive alien plant species, horticulture, survey, Sarajevo

ROOT PATHOGENS OCCURRING ON PEA (PISUM SATIVUM) AND FABA BEAN (VICIA FABA) IN GERMANY

Šišić A.[1], Baćanović-Šišić J.[2], Schmidt H.[3], Finckh M. R.[1]

[1]Kassel University, Department of Ecological Plant Protection, Witzenhausen, Germany
[2]Kassel University, Section of Organic Plant Breeding and Agrobiodiversity, Witzenhausen Germany
[3]Foundation Ecology and Agriculture (SOEL), Ahrweiler, Germany

Summary

In the period between 2016 and 2018, a survey was conducted within the framework of the German demonstration network on peas and beans to assess root health status of pea (*Pisum sativum*) and faba bean (*Vicia faba*) in 102 conventionally and 83 organically managed fields in Germany, and to characterize diversity and frequency of root-associated *Fusarium* and *Didymella* spp.
A total of 5167 *Fusarium* and 1438 *Didymella* isolates were recovered over the sampling period and these represented 14 different *Fusarium* and 4 different *Didymella* species. The number of recovered *Fusarium* isolates was similar in conventional and organic fields in each year, whereas *Didymella* was found predominantly in organically managed fields on both crops. In faba bean, *Fusarium redolens* and *Didymella pinodella* were the species that showed higher root colonization rates in organic fields compared with conventional ones. In contrast, *F. avenaceum*, *F. tricinctum* and *F. culmorum* were more prevalent and colonized more frequently roots in conventionally managed fields. The species *F. oxysporum, F. solani* and *F. equiseti* were common in both, organic and conventional fields. For pea, preliminary data suggest different tendencies for the various species and a strong influence of the weather on isolation frequencies. For example, *F. oxysporum* was found more frequently on spring sown cultivars compared to winter sown cultivars in both, organic and conventional system, whereas *D. pinodella* was found with particularly high frequencies in organic winter cultivars.
Our results suggest an increasing importance of *F. redolens* and *D. pinodella* in grain legume production in Germany. The dominance of the species in the pathogen complex causing foot and root rot appears to be relatively recent, and their epidemiology, impact on yield and aggressiveness needs to be further investigated.

Key words: Grain legumes, foot and root rot, pathogens, Fusarium, Didymella

DISEASES OCCURRING ON HORDEUM BULBOSUM FIELD POPULATIONS AT BİNGÖL PROVINCE OF TURKEY

Karakaya A.[1], Çelik Oğuz A.[1], Saraç Sivrikaya I.[2]

[1]Ankara University, Faculty of Agriculture, Department of Plant Protection, Dışkapı, Ankara, Turkey
[2]Bingöl University, Faculty of Agriculture, Department of Plant Protection, Bingöl, Turkey

Summary

Hordeum bulbosum is one of the wild barley species naturally growing in Bingöl province of Turkey. This wild species is an important gene source for obtaining disease resistant barley plants. In 2018, a survey was carried out in order to determine the diseases occurring on *Hordeum bulbosum* plants in Bingöl province. Twenty-seven naturally growing *Hordeum bulbosum* populations from Bingöl central district and Genç, Adaklı, Kiğı, Karlıova and Solhan districts were examined. Five *Hordeum bulbosum* populations were disease free. Powdery mildew caused by *Erysiphe graminis* f. sp. *hordei*, leaf rust (brown rust) caused by *Puccinia hordei*, spot form of net blotch caused by *Drechslera teres* f. *maculata* and scald caused by *Rhynchosporium commune* were observed on other populations. Powdery mildew was the most common pathogen followed by leaf rust (brown rust), spot form of net blotch and scald.

Key words: Hordeum bulbosum, disease resistance, Bingöl, wild barley, Turkey

THE INFLUENCE OF CHANGES IN WAY OF USE, IN CLIMATE AND IN HYDROLOGICAL CONDITIONS ON HISTOSOL IN RECLAMATION AREA IN PEATLAND ŽDRALOVAC

Tvica M.[1], Čivić H.[1], Tunguz V.[2]

[1]University of Sarajevo, Faculty of Agriculture and Food Science, Sarajevo, Bosnia and Herzegovina
[2]University of East Sarajevo, Faculty of Agriculture, East Sarajevo, Bosnia and Herzegovina

Summary

Fen type peatland Ždralovac in Livanjsko Polje (Livno's karsts field) in south-west Bosnia and Herzegovina, traditionally were used for livestock grazing with mowing grass, agricultural production by the sides of the field and peat excavation for own necessaries. The 1970s at southern part peatland with shallow peat is built a reclamation area Table (1000 ha) used for agricultural production. The entire hydro meliorated system is designed based on shallow and controlled drainage with the system of water-gates that maintained the water table at a depth which enabled the continuous capillary wetting of the rhizosphere in the dry summer period. As the peatland during the spring is mostly flooded (limited vegetation period) and due to the high investment in hydro melioration, mainly high-profit vegetable crops were grown. Since the peatland is rich in total nitrogen and is poorly supplied with accessible forms of phosphorus and potassium, the safe and high yields have been continuously provided with the appropriate agro-techniques. After the last war (1991-1995) in Bosnia and Herzegovina, these areas were abandoned over the past 20 years so that the entire system of water-gates is now devastated. Peatland use change and uncontrolled drainage together with climate change are caused prolonged drying of the surface layer in the summer period. This has further caused accelerates peat mineralization by changing its traits and reducing the peat depth to only 20 cm. Everything was followed numerous long-lasting fires by the changes in vegetation cover on agricultural areas that overgrown into grassy surfaces, shrubs and trees. The possibility of restoration of agricultural production on these surfaces primarily includes the continuous supply crops with the water in the summer period.

Keywords: peatland, drainage, climate change, Histosol

SURVIVOR OF SOIL MICROBIAL POPULATION AFTER GLYPHOSATE APPLICATION

Lalević B.[1], Hamidović S.[2], Gavrić T.[1], Sunulahpašić A.[3], Borovac B.[1], Kazlagić A.[1], Delić M.[1]

[1]University of Belgrade, Faculty of Agriculture, Belgrade-Zemun, Serbia
[2]University of Sarajevo, Faculty of Agriculture and Food Sciences, Sarajevo, Bosnia and Herzegovina
[3] Ministry of agriculture, water management & forestry of Central Bosnia Canton, Travnik, Bosnia and Herzegovina

Summary

Modern agricultural production is often associated with application of agrochemicals. One of them is glyphosate, which has been used since 1970s and has become one of the most widely used herbicides in weed control. However, the widespread use of glyphosate may influence the living organism`s activity. The aim of this paper was to estimate the soil microbial activity after glyphosate application. Glyphosate (Glifomark SG) was applied in the end of 2017 at two locations: Principovo polje, and Novi Travnik (Travnik municipality, Bosnia and Herzegovina), for removal of corn, and raspberry residua, respectively. Soil sampling (0-10 and 10-30 cm) was performed at time zero, and 15 and 45 days after time zero. In control, glyphosate was not applied. Chemical characterization (pH, content of humus, available P and K, and carbonates) was conducted using standard methodology, whilst microbial diversity (total number of bacteria, ammonification bacteria, fungi, actinomycetes and glyphosate-tolerant bacteria) by agar plate method. The results of chemical characterization showed slightly acid to slightly alkaline pH value, moderate to high humus content, and low to high content of available P and K. In most of samples, bacterial number was reduced 15 days after glyphosate application, whilst at the end of experiment increase of bacterial abundance was recorded. Similar results were obtained for fungi. Rapid decrease of actinomycetes number was observed after application of glyphosate. Two bacterial strains (PP-23 and NT-11) was able to grow on mineral medium supplemented with glyphosate in concentrations of 1 and 2% (v/v), which represents a promising candidate for bioremediation of soil contaminated with glyphosate.

Key words: microbial diversity, glyphosate, bacteria, bioremediation of soil

CURRENT SITUATION OF RICE BLAST DISEASE IN EDİRNE, TURKEY

Seidi M.[1], Karakaya A.[2], Akın K.[1], Çelik Oğuz A.[2]

[1]Trakya Agricultural Research Institute, Edirne, Turkey
[2]Ankara University, Faculty of Agriculture, Department of Plant Protection, Dışkapı, Ankara, Turkey

Summary

Rice (*Oryza sativa L.*) is one of most important cereal crops in Turkey. More intensive rice production areas in Turkey are located in the Thrace region. Rice blast disease caused by the fungus *Pyricularia oryzae* is one of the most important pathogens that negatively affect the yield and quality of rice plants. In 2018, a total of 22 rice fields were surveyed in Keşan, Meriç, Uzunköprü, İpsala, Enez and Havsa districts of Edirne province for the presence of rice blast disease. The rice blast disease severity and prevalence values in these districts varied. A 0-5 scale was used for evaluation. The highest disease severity was observed in Havsa district (48.40%), followed by Uzunköprü (27.68%), Meriç (26.20%), Keşan (19.23%), İpsala (19.12%) and Enez (6.40%) districts. The highest prevalence of the disease was observed in Havsa district (100%), followed by Meriç (71.43%), Uzunköprü (69.15%), Keşan (62.73%), İpsala (33.66) and Enez (13.00%) districts.

Key words: Rice blast disease, rice, Pyricularia oryzae, Magnaporthe oryzae, Edirne, Turkey

PREVALENCE OF BOTRYTIS CINEREA IN TOMATO GREENHOUSES IN ANTALYA PROVINCE OF TURKEY AND PHENOTYPIC CHARACTERIZATION OF ISOLATES

Gül E., Karakaya A.

Ankara University, Faculty of Agriculture, Department of Plant Protection, Dışkapı, Ankara, Turkey

Summary

Botrytis cinerea is one of the most important fungal diseases that decrease the yield and quality of tomato plants especially under greenhouse conditions where intensive cultivation was carried out. The fungus can infect plants under field, garden, greenhouse and storage conditions. *B. cinerea* has ability to infect all aboveground parts of the plant during the vegetation period, it is prone to fungicide resistance and has high genetic variation. These features make control of the pathogen difficult. Antalya province of Turkey is an important tomato growing area and greenhouse production of tomatoes in this province is common. In 2018, a survey was conducted in Serik, Aksu, Kumluca, Finike and Kepez districts of Antalya province. Infected tomato plant samples were obtained from 35 greenhouses. *B. cinerea* was found in all surveyed districts of Antalya province. The disease was more common in Serik district. The percentages of *B. cinerea* isolated from diseased tomato parts were 64, 20, 35, 22 and 29 from Serik, Kumluca, Kepez, Finike and Aksu districts, respectively. Phenotypic characterization of the isolates revealed that the most common phenotype was S3.

Key words: Antalya, Tomato, Botrytis cinerea, Phenotypic characterization

DETERMINATION OF THE PREVALENCE OF TOMATO LEAF MOLD DISEASE IN GREENHOUSES OF BARTIN AND ZONGULDAK PROVINCES OF TURKEY

Gül E., Karakaya A.

Ankara University, Faculty of Agriculture, Department of Plant Protection, Dışkapı, Ankara, Turkey

Summary

Tomato leaf mold disease caused by *Cladosporium fulvum* (*Passalora fulva*) is an important disease of tomatoes growing especially in greenhouse conditions. In 2019, 27 and 29 greenhouses were inspected for the presence of tomato leaf mold disease in Bartın and Zonguldak provinces of Turkey, respectively. Tomato leaf mold disease was present in 20 Bartın greenhouses (74.1%) and 10 Zonguldak greenhouses (34.5%). Percentages of the disease ranged between 5-100 and 15-100 in disease occurring greenhouses in Bartın and Zonguldak provinces, respectively. Severe disease symptoms were observed in some greenhouses resulting in complete drying of the leaves. Precautionary measures should be taken in order to control the disease in Bartın and Zonguldak greenhouses.

Key words: Cladosporium fulvum, Passalora fulva, *tomato leaf mold disease, Bartın, Zonguldak, Turkey*

EFFECT OF BIO-STIMULATORS AND INOCULATION ON THE PEA YIELD (*PISUM SATIVUM L.)*

Filipović A., Pažin M., Ostojić I., Mandić A., Vasilj V.

University of Mostar, Faculty of Agriculture and Food-technology

Summary

The research aimed to determine the efficiency of the nodule bacterization and the application of bio stimulators to the vegetative growth of pea yield (*Pisum sativum L.*). One-factor field trial was set up by a random block design in three replications with four different treatments. The treatments included a variant with the applied bio stimulator, a variant with the inoculation of nodular applied bacteria, a variant that implied the combination of the first two and the control variants (without any application). Morphological properties were observed (number of plants per variants, the mass of pods, stem height, number of nodules per root) and the pods yield of was determined. The results showed that the average yield of pea cultivars of "Čudo Amerike" is significantly higher when using a combination of mycorrhization and bio stimulators, even by 21% compared to the control variant, whereas the individual effect of mycorrhization or application of bio stimulators shows a lower yield of about 11% compared to the highest achieved yield 1134.3 g/m^2. A similar result is followed by the weight of the pods, where the largest mass was obtained in a combined variant of 9.67 g, which is by 42% more than the weight produced in the control variant and for 12% more than the individual effects of mycorrhization and used bio stimulator on mass of pods. The number of pods showed statistically significantly higher results for 48% of the variants with combination and individually applied bio stimulators then the control variant. Stem height was found to be significantly different in all variants of the experiment. The height of the stem was greatest in a combined variant with an average of 55.63 cm, followed by a variant with applied bio stimulators of 49.78 cm and mycorrhization of 46.16 cm. The lowest stem height had a control variant of 35.97 cm. The number of nodules showed 78% lower nodules on variants with the applied bio stimulators and the control variant.

Key words: Pisum sativum L., yield, mycorrhization, bio stimulator

MOLECULAR AND BIOLOGICAL CHARACTERIZATION OF BLACK RASPBERRY NECROSIS VIRUS ON RED RASPBERRY IN SERBIA

Jevremović D., Leposavić A., Paunović S. A.

Fruit Research Institute, Čačak, Serbia

Summary

Black raspberry necrosis virus (BRNV) is considered as economically important virus infecting raspberries. In black raspberry (*Rubus occidentalis L.*) BRNV is causing cane tip necrosis, but infected red raspberry (*Rubus idaeus L.*) cultivars in general do not express foliar symptoms.

From 2014−2018, a number of 105 samples from 9 red raspberry cultivars (‘Almira’, ’Fertödi Zamatos’, ’Glen Ample’, ’Meeker’, ‘San Rafael’, ’Polana’, ’Polka’, ’Tulameen’ and ‘Willamette’) were collected from different localities in Serbia. Samples were tested on the BRNV presence by reverse transcription-polymerase chain reaction (RT-PCR) using specific primers targeting 417 bp nucleotide (nt) fragment of the RNA-dependent RNA polymerase (RdRp) region of RNA 1 of the BRNV genome. BNRV was detected in 19 samples in cultivars ’Fertödi Zamatos’, ’Polana’, ’Tulameen’ and ‘Willamette’.

A 417nt sequence of the RdRp was determined for 5 isolates. The nt sequences of these isolates were 94.2−99.7% identical. When compared to available sequences of BRNV isolates from North America and Europe, Serbian isolates showed significant divergence (80.0−82.2% of nt identity).

A portion of the BRNV infected plants of cultivar ’Fertödi Zamatos’ were further tested on indicator *R. occidentalis* by inarch bottle grafting. Two months after inoculation cane tip begun to curl down and became necrotic on all inoculated plants. Non-grafted control plants were symptomless.

Keywords: BRNV, red raspberry, RT-PCR, bottle grafting, diversity

DETERMINATION OF MICROELEMENTS IN ORGANIC AND CONVENTIONAL PRODUCED BUCKWEAT SEEDS (*FAGOPYRUM ESCULENTUM*) USING ICP-OES

Golijan J. M.[1], Kostić A. Ž.[2], Dojčinović B. P.[3], Milinčić D. D.[2], Pešić M. B.[2], Barać M. B.[2], Lekić S. S.[2]

[1]University of Belgrade, Faculty of Agriculture, Chair of Genetics, Plant Breeding and Seed Production
[2]University of Belgrade, Faculty of Agriculture, Chair of Chemistry and Biochemistry
[3]Institute of Chemistry, Technology and Metallurgy, Belgrade

Summary

Sustainable food production is gaining global importance due to numerous consequences caused by conventional agriculture. Organic farming is a system that achieves sustainable and safe food production, without any disadvantages for consumers health, plants and animals, while preserving the ecosystems. Due to growing interest in organically produced foods, organic buckwheat (*Fagopyrum esculentum*) production is taking place on even larger areas. Numerous worldwide studies have shown that there is a difference in the mineral composition between organic and conventional foods. Most of chemical elements, in certain quantities, have an adequate physiological function in a plant. In addition to the macroelements necessary in larger quantities, for the survival and normal plant function, microelements are also needed, but in significantly smaller amounts. The aim of this study was to determine the existence of differences in the content of microelements (B, Cu, Fe, Mn, Mo and Zn) in organically and conventionally produced buckwheat seeds, during 2016. The determination of these elements was conducted by using Inductively Coupled Plasma Optical Emission Spectrometry (ICP- OES) with previous digestion of samples and results were expressed as mg/kg of dry weight (DW). The obtained results for the examined elements revealed that the lowest content in both analyzed seeds was for borone, while only molybdenum was below the detection limit. In conventional buckwheat seed, higher quantity of B (2.66 mg/kg DW), Cu (5.70 mg/kg DW) and Zn (15.20 mg/kg DW) was determined, while organic buckwheat seed contained higher content of Fe (122.55 mg/kg DW) and Mn (116.63 mg/kg DW) compared to conventionally grown sample.

Key words: organic production, conventional production, Fagopyrum esculentum, microelements, ICP-OES

EFFECTS OF ORGANIC AND CONVENTIONAL PRODUCTION OF MAIZE ON SEED VIGOUR

Golijan J.[1], Jovičić D.[2], Popović A.[3], Lekić S.[1]

[1]University of Belgrade, Faculty of Agriculture, Serbia
[2]Institute of Field and Vegetable Crops Novi Sad, Serbia
[3]Maize Research Institute „Zemun Polje", Belgrade, Serbia

Summary

Seed quality and origin are of the utmost importance for the production and yield of crops. There are many tests for the seed vigour determination. The seed accelerating ageing test is one of the most important tests that determine the seed germination reduction under unfavourable conditions. The objective of the present study was to establish the effect of different production methods (organic and conventional) on seed vigour of maize variety Rumenka by the application of the seed accelerating ageing test (ISTA Rules, 2018). Seeds were exposed to the high temperature (41^{o}C) and high air humidity (100%) for 72h. After the treatment, seed germination was established by the standard method (ISTA Rules, 2018). The application of the seed accelerating ageing test for the determination of vigour of organically produced seed showed that germination was higher (78.5%) than the one established by the standard laboratory test (70.75%). Stress conditions resulted in the reduction of the root length (120.75 mm), increase of the length (117.13 mm) and fresh weight of the above-ground part (4.56 g), while the values of the root fresh weight, dry weight of the above-ground part and the root did not statistically differ. The values of seed vigour and germination of conventionally produced maize determined by the seed accelerating ageing test were higher (41.5% and 46.25%, respectively), while the percentage of nongerminated seeds was also higher (38.75%). Furthermore, after the treatment, the length (105.88 mm) and the fresh weight (4.43 g) of the above part was reduced, while the values of the length (137.5 mm), fresh (2.39 mm) and dry weight (0.28 mm) of the root and above-ground part dry weight (0.31 g) were higher than those established by the standard laboratory method (127.88 mm; 1.89 g; 017 mm; 0.31 g).

Key words: vigour, organic production, conventional production, maize seed

PHYSICAL AND CHEMICAL CHARACTERISTICS OF THE PEACH VARIETIES IN THE HERZEGOVINA AREA

Aliman L.[1], Aliman J.[2], Ercisli S.[3], Skender A.[4], Šukalić A.[2], Šupljeglav Jukić A.[2]

[1]University of Sarajevo, Faculty of Pharmacy, Bosnia and Herzegovina
[2]University of Mostar, Agromediterranean faculty, Bosnia and Herzegovina
[3]Atatürk University, Agricultural Faculty, Erzurum, Turkey
[4]University of Bihać, Biotechnical faculty, Bosnia and Herzegovina

Summary

The aim of this study was to examine the impact of different agro-ecological conditions on the physical (weight, height, width, thickness) and chemical (the soluble solids content (%), total sugar content (%), total acid content (%) and maturity index) characteristics of five peach varieties in Herzegovina. The fruits for analysis were taken of Maycrest, Springcrest, Spring Lady, Rich Lady and Elegant Lady varieties from the area of Mostar, Stolac and Čapljina for three years (2009-2011). The results of research show that the locality influenced the examined physical parameters of the fruits, but had no effect on the fruit/stone ratio (randman). The highest values of the weight, height, width and thickness of the fruit and stone were recorded in Rich Lady and Elegant Lady peaches in the Dubrava plateau.

The results show statistically significant differences in the chemical composition of peach fruit depending on variety and locality. The highest average soluble solid content and total sugars were measured in the Elegant Lady in Mostar, while the lowest content of these compounds was found in the Maycrest and Rich Lady.

The highest total acid content was found in Maycrest variety in Stolac and the lowest content in the Elegant Lady variety (Mostar). The largest index of ripening had the variety the Elegant Lady (Mostar), and the lowest variety of the Maycrest in Stolac.

It can be concluded that the investigated varieties in all three localities had an excellent quality of fruit in terms of physical and chemical characteristics and can be recommended to farmers for wide cultivation in Herzegovina.

Key words: peach, physical and chemical characteristics, fruit

THE EFFECT OF PRUNING ON FRUITING CAPACITY OF MUSCAT BLEU TABLE GRAPE VARIETY

Delić M.[1], Behmen F.[1], Sefo S.[2], Matijašević S.[3], Hamidović S.[1]

[1]University of Sarajevo, Faculty of Agriculture and Food Sciences, Bosnia and Herzegovina
[2]University "Džemal Bijedić" of Mostar, Agromediterian Faculty, Bosnia and Herzegovina
[3]University in Belgrade, Faculty of Agriculture, Serbia

Summary

The study of the effect of various types of pruning on fruiting of Muscat Bleu grape variety in the conditions of Herzegovina lasted for three years. Three pruning variants (28, 32 and 40 buds/vine) were applied in four repetitions. On the basis of obtained results, it is evident that the yield of grapes per vine and the number of clusters per vine was the highest in 2011. year (10.30 kg and 45.98). The yield of grapes per vine (7.59 kg) was the smallest in 2012., and the number of grapes per vine in 2013. (25.93); total number of productive canes/vine was the highest in 2012 (26.62), and the lowest in 2013. year (total number of productive canes/vine 22.65, number of productive canes/vine 22.47). Pruning variant III had the highest levels of these parameters in all three experimental years, and variant I the lowest.

Key words: Muscat Bleu, table grapevine, pruning, yield.

MARIGOLD (*CALENDULA OFFICINALIS* L.) AS AN ALLELOPTHIC ACTIVE CROP

Sjerotanović A., Đikić M., Gadžo D., Karić L., Bašić F.

University of Sarajevo, Faculty of Agriculture and Food Sciences, Bosnia and Herzegovina

Summary

Allelopathy is a biochemical interaction among plants mediated by chemical compounds, usually secondary metabolites that excrete some plants. Chemical compounds produced in plants are usually by-products of basic chemical processes in plant life, and plants can produce them in all their parts. In this paper the allelopathic activity of the marigold (*Calendula officinalis* L.) was studied. Under the laboratory conditions the influence of marigold flower extract on the initial growth parameters of three weed species: *Amaranthus retroflexus*, *Hibiscus trionum*, and *Taraxacum officinale* was examined. Aqueous extract of marigold flowers at concentrations of 5 and 10% statistically significantly inhibited germination of all investigated weeds. The concentration of 2% inhibited the number of seedlings of *Taraxacum officinale*, while on the other two weeds did not work. According to the obtained results, it can be concluded that the marigold possesses the allelopathic potential to the investigated weeds, but the research should be continued, both in the laboratory and in the field.

Key words: allelopathy, marigold, aqueous extract, initial growth parameters, weeds

IMPACT OF CUTTING REGIME ON DRY MATTER AND CROUDE PROTEIN YIELDS IN SOWN GRASSLANDS

Bezdrob M.[1], Simić A.[2], Gavrić T.[1], Dokso A.[1], Rakita N.[1], Hamidović S.[1]

[1] University of Sarajevo, Faculty of Agriculture and Food Sciences, Sarajevo, Bosnia and Herzegovina
[2]University of Belgrade, Faculty of Agriculture, Zemun, Serbia

Summary

From the viewpoint of roughage forage production in Bosnia and Herzegovina, grasslands are the most significant resource as they account for more than 50% of total agricultural area. Sown grasslands, commonly known as grass-clover mixtures, are usually composed of different species of grasses and legumes. Apart from pure legume crops, high yields of good quality forage can also be achieved by the mixtures of legumes and grasses, since legumes contribute to the soil fertility and better nitrogen nutrition. As the quality and productivity of plant mass from grasslands primarily depends on botanical composition and time of cutting in relation to the stage of plant development at the time of cutting, the impact of cutting regime on the yield of dry mass and crude proteins in different types of grasses and legumes was studied with special emphasis on different defoliation regime. The research results indicate that the cutting of legumes at blooming stage achieved a significantly higher yield of dry mass and proteins compared to the yields achieved by other cutting regimes. Overall, the mixture consisting of bird's-foot trefoil, red clover, Italian ryegrass, timothy-grass and orchard grass, 20% each, proved to be the most productive regardless of the cutting regime. Dry mass yield in this mixture amounted to 20.35 t ha^{-1} (pasture imitation phase); 21.53 t ha^{-1} (legume budding phase); and 25.64 t ha^{-1} (legume flowering phase). The highest two-year protein yield levels at the phases of legume budding and flowering were achieved by variant S2 (3084.02 kg ha^{-1} and 2579.06 kg ha^{-1}), which had a high percentage of bird's-foot trefoil.

Key words: sown grasslands, cutting regime, dry mass and crude protein yield

INFLUENCE OF DIFFERENT *PLUM POX VIRUS* STRAINS ON CHEMICAL COMPOSITION OF 'ČAČANSKA LEPOTICA' PLUM FRUIT CULTIVAR

Miletić N.[1], Jevremović D.[2], Mitrović O.[2], Gvozdenović O.[1], Pajić M.[1]

[1]Faculty of Agronomy, University of Kragujevac, Čačak, Serbia
[2]Fruit Research Institute, Čačak, Serbia

Summary

Plum pox virus (PPV) is economically the most important virus of stone fruits. In sensitive plum (*Prunus domestica L.*) cultivars PPV causes foliar symptoms, fruits deformation, changes in the chemical composition of fruits and premature fruit drop.

Fruits of 'Čačanska lepotica' plum cultivar were collected from an experimental orchard in locality Čačak. Samples were collected from 15 trees (5 infected with PPV-D, 5 infected with PPV-Rec and 5 from PPV-free trees). Trees for sampling were selected after the RT-PCR analysis of the trees from the plantation using PPV strain-specific primers. The fruits were picked at five different terms at seven-days interval during maturation stage, starting from a fully green and immature fruits as the initial harvest stage, and terminating four weeks later with fruits being soft and overripened.

All tested samples, 10 PPV-infected and 5 uninfected, were further chemically analyzed. The analyses included determination of total dry matter, soluble solid content, pH value and titratable acidity, total anthocyanin content, total phenolic content and antioxidant capacity.

The aim of this work was to reveal the possible changes in chemical composition in the fruits of 'Čačanska lepotica' cultivar, grown at the same locality, caused by the two different PPV strains.

Key words: PPV, plum, RT-PCR, phenolics, antioxidant capacity

DETERMINATION OF SUGARS AND ORGANIC ACIDS IN PEAR FRUIT BY HPLC ANALYZE

Memić S.[1], Drkenda P.[2], Vranac A.[2], Akagić A.[2], Musić O.[2]

[1] Bosmal City Center, Sarajevo
[2]University of Sarajevo, Faculty of Agriculture and Food Sciences, Sarajevo, Bosnia and Herzegovina

Summary

Sugars and organic acids contents of nine autochthonous and one commercial pear varieties were identified and quantified by high performance liquid chromatography (HPLC). The fruit analyses were done in two growing seasons (2012 and 2013). In analyzed pear fruits were identified fructose, glucose, sorbitol and sucrose. Fructose was the predominant sugar in analyzed pear varieties. Significant differences were found between sucrose, glucose, fructose, and sorbitol depending on variety and climatic conditions. Among the individual organic acids, malic acid was predominately present in all investigated pear varieties. Beside malic acid in fruits of pear were identified citric, shikimic and fumaric acids. Pear variety and climatic conditions had significant influence on content of organic acids in fruits. The varieties 'Takiša' and 'Hambarka' are distinguished from the other pears according to the significantly higher content of total sugar contents. The 'Krakača' variety had significantly higher content of total organic acids than the other analyzed pear varieties.

Key words: autochthonous, pear variety, sugars, organic acids, HPLC

DYNAMICS OF MICROBIAL POPULATIONS ACTIVITIES AFTER THE APPLICATION OF NICOSULFURON

Hamidović S.[1], Lalević B.[2], Borovac B.[1], Kazlagić A.[1], Haseljić S.[1], Raičević V.[2], Djikić M.[1]

[1]University of Sarajevo, Faculty of Agriculture and Food Sciences, Sarajevo, Bosnia and Herzegovina,
[2]University of Belgrade, Faculty of Agriculture, Belgrade-Zemun, Serbia

Summary

Nowadays, obtaining high productivity in plant production is impossible without the use of herbicides. One of them is nicosulfuron, a selective herbicide with translocating activity, most commonly used in weed control. However, unprofessional use of nicosulfuron can affect microbial diversity and enzymatic activity in the soil. The aim of this study was to determine the microbial diversity and enzymatic activity of the soil after the application of nicosulfuron. Nicosulfuron was applied in the spring of 2018 in two locations: Divjak and Turbe (Travnik municipality, Bosnia and Herzegovina), in corn crops after sprouting, with the aim of suppressing annual and perennial weeds. Samples were taken in the spring of 2018 from a depth of 0-10 and 10-30 cm, before the use of herbicides (control samples) and 15 and 45 days after the herbicide application. Nicosulfuron was not used in the control samples. Standard methodology was used for the determination of chemical parameters (pH, humus content, available P and K), while microbial diversity (total number of bacteria, number of ammonias, fungi and actinomycetes) was determined by agar plate method. Dehydrogenase soil activity (DHA) was determined using method by Casida et al. (1964). The results of the chemical analysis showed slightly acidic to neutral pH, moderate to high humus content, and low to high contents of P and K in the samples from both locations. In most samples, the highest number of bacteria was recorded 15 days after the application of nicosulfuron, while the lowest number of bacteria was at the end of the experiment (45 days after the herbicide application). The number of fungi was also the highest 15 days after the nicosulfurone application, slightly less after 45 days, and the lowest number of fungi was recorded in the control samples. The number of actinomycetes has been significantly reduced after the application of nicosulfuron. The obtained results indicated that the soil dehydrogenase activity was the lowest prior to the herbicide application and the highest 15 days after its application, which indicates the correlation between the dehydrogenase activity and the total number of bacteria in the soil.

Key words: soil, nicosulfuron, microorganisms, dehydrogenase activity

GENETIC CHARACTERIZATION OF AUTOCHTHONOUS VARIETIES OF LUBENIČARKA PEAR

Radoš Lj., Vučković B., Krmpot T., Kovačević Z.

University of Banja Lluka, Faculty of Agriculture, Banja Luka, Bosnia and Herzegovina

Summary

Wider Banja Luka region has a very important gene pool of the old autochthonous varieties of different fruit species. Naturally, an important place in this gene pool is occupied by autochthonous varieties of pears that have various periods of maturation, interesting commercial and technological characteristics, and are sources of resistance genes to the economically most important diseases and pests, as well as to the external environmental conditions. Seven pear accessions (Pyrus communis L.) were used in this study (accession G_14 'Lubeničarka' and accession G_17 'Lubeničarka' town Banja Luka, accession G_15 'Lubeničarka' and accession G_16 'Lubeničarka' municipality of Srbac, accession G_18 'Prava Lubeničarka', accession G_19 'Obična Lubeničarka' and accession G_20 'Krupna Lubeničarka' municipality of Prnjavor). Traditional methods of cultivar characterization based on agronomic and morphological parameters are strongly affected by environmental conditions and phenological stage of the plants. Therefore, they are being replaced by or most often complemented with different DNA markers. Genetic identification of selected accessions of Lubeničarka pears was done using AFLP markers. Based on the calculated coefficients of difference, the variations between the studied accessions demonstrated existence of 3 groups of accessions. The group I consists of only accession G _19 indicated that this accession the most probably does not belong to the Lubeničarka type. Accessions G_15, G_16, G-17 and G_18 make the II group, while III group comprises accessions G-14 and G_20.

Key words: AFLP markers, Pear, Autochthonous, Accessions.

CHEMICAL COMPOSITION AND TOTAL PHENOLS CONTENT OF TARTARY BUCKWHEAT (*FAGOPYRUM TATARICUM GAERTN*) GROWN IN DIFFERENT VEGETATION SEASONS

Gavrić T., Gadžo D., Jurković J., Đikić M.,. Hadžić Dž, Lalević B., Hamidović S.

University of Sarajevo, Faculty of Agriculture and Food Science, Sarajevo, Bosnia and Herzegovina

Summary

Tartary buckwheat (*Fagopyrum tataricum Gaertn*) is an annual plant that is classified as a pseudocereal with high nutritional values. It is mainly cultivated in Asia, where grain and other parts of plants are used in traditional diet. In recent years, tartary buckwheat is grown on smaller areas and mostly in a mixture with common buckwheat in Bosnia and Herzegovina. The aim of this research was to determine the chemical composition and total phenols content of tartary buck-wheat grown in different vegetation seasons. Field experiments were conducted in Donje Selo, near Ilijaš during 2011, 2012 and 2013 vegetation seasons. The results show that weather in some vegetation seasons have statistically significant effect on contents of protein and starch in kernel. The largest contents of protein were found in vegetation season with a lack of precipitation (2012 year), while the largest content of starch was recorded in years with relatively higher precipitation levels (2011 and 2013 years). Results show that total phenols content de-pended on the plant organ and vegetation season. The highest content was found in the flower (63.63 mg GAE g^{-1}), while the smallest content was found in the kernel (5.03 mg GAE g^{-1}).

Keywords: tartary buckwheat, vegetation seasons, protein, starch, total phenols

THE IMPACT OF GROWING TECHNOLOGY ON YIELD OF SWEET CORN

Gavrić T., Omerbegović O., Karić L., Muminović Š., Gadžo D., Bezdrob M.

University of Sarajevo, Faculty of Agriculture and Food Sciences, Sarajevo, Bosnia and Herzegovina

Summary

Sweet corn (*Zea mays ssp. saccharate Sturt.*) is a sub variety of corn that is very popular in human diet. It is used at the end milk stage, which is characterized by a short duration. There are different growing technologies in order to extend the harvest time of sweet corn in the world. Some of them are beginning to be used in our region. The aim of this work was to determine the morphologically-productive properties of sweet corn produced using different technologies (seeding and transplanting). The field experiment was set up at the field of Faculty of Agriculture and Food Sciences in Sarajevo. It was used a hybrid of sweet corn ˝Gold cup˝ in this research. Field experiment was designer with four repetitions for each variant. The size of a basic plot was 20 m^2. The results of research shown that growing technologies of sweet corn had significant effect on yield and harvest time. The higher yields of sweet corn have been found in experiment variants of transplantation. The harvest time of sweet corn in variants of transplanting occurred earlier by 14 and 18 days compared to the variants of sweet corn grown in variates of seeding.

Keywords: sweet corn, growing technology, transplanting, seeding, yield

OBSTACLES AND OPPORTUNITIES FOR URBAN AGRICULTURE IN BOSNIA AND HERZEGOVINA

Glamočlija P., Karić L.

University of Sarajevo, Faculty of Agriculture and Food Sciences, Sarajevo, Bosnia and Herzegovina

Summary

Urbanization and expected global population growth are putting pressure on natural resources and changes in land use. Increased consumer awareness and demand for safe, nutrition, sustainable food production as well as concern planet are transforming our food systems. Urban agriculture has emerged as one of alternatives for high value crops production. A modern technology has enabled less labour intense, smart and precision agriculture thus enabling engagement of persons without previous knowledge and experience in food production. To define obstacles, barriers and motives of urban dwellers to engage in urban food production we conducted an online survey in Bosnia and Herzegovina (n=94). Results are discussed according to clusters, age and genders. Accordingly, most important motive for people engaged in urban agriculture is concern for personal Health and Wellness followed by Home budget savings. Health and Wellness are also leading motive for newcomers. Most import obstacles are Lack of space followed by Lack of available free time. Accordingly, more than 91% of surveyors claim to be willing to engage in urban agriculture if obstacles removed. Results indicate directions, benefits and methodology to be used for communicating urban agriculture to urban dwellers in Bosnia and Herzegovina.

Key words: urban agriculture, urban farming, urban lifestyle, urban food systems, agriculture

YIELD AND PHENOL CONCENTRATIONS OF KALE MICROGREENS AUTOCHTHONOUS VARIETIES FROM REGION OF HERZEGOVINA

Smajić S., Glamočlija P., Zahirović Ć., Karić L.

University of Sarajevo, Faculty of Agriculture and Food Sciences, Sarajevo, Bosnia and Herzegovina

Summary

Microgreens are emerging new crops described as young and tender edible seedlings of vegetables, fruits, herbs, aromatic and medicinal, and wild plant species. Variety of flavours, colours, textures, good nutritional values, short production cycle, short shell life, and high seeding rate is making microgreens ideal crop for urban farming. Microgreens are gaining popularity as a super food, since they are high in vitamins and nutrients. Among vegetable varieties Brassica microgreens are considered the richest in phenolic antioxidants.

The aim of this study was to assess the use of autochthonous kale varieties for microgreens production. We have compared yield and phenol content of 2 commercial and 3 traditional kale varieties from Bosnia Herzegovina. Highest yield was obtained from commercial variety Bonanza F1 (3,714kg/m^2) while lowest yield was from traditional variety Blagaj (0,588kg/m2). Highest phenol content was obtained from Blagaj (72,35 mg/100 g FW) while lowest phenol content was from Bonanza F1 (27,59 mg/100 g FW).

Key words: microgreens, kale, autochthonous varieties, urban agriculture.

ANIMAL PRODUCTION

DETERMINATION OF EGG QUALITY TRAITS OF ATAK'S HENS KEPT IN DIFFERENT REARING SYSTEMS

Demirel D., Demirel R.

Dicle University, Faculty of Agriculture, Dep. of Animal Science, Diyarbakir – Turkey

Summary

This study was conducted to compare the internal and external quality characteristics of the eggs of Atak'S laying hybrids kept in enriched cage and free-range rearing systems. In the study; 400 Atak'S hybrids, 31 weeks of age were fed for 6 weeks of experimental period. Throughout the experiment, with weekly intervals, 15 eggs of each group were collected from the laying hens kept in both systems for determination of the quality of the exterior (egg shape index and eggshell thickness) and interior (albumen and yolk width, height, yolk height and yolk colour). At the end of the experiment, there were statistically significant differences between groups for Haugh unit (wk. 2), albumen index (wk. 6), egg shall rate (wk. 1, 2 and 3), egg shall thickness (wk. 6), yolk colour for L (wk. 3) and for a (wk. 1 and 3). However, there were no significant differences between groups for other weeks and mean values, egg weight, shape index and yolk index.

Keywords: Egg quality, enriched cage, free-range system, laying hen

EFFECT OF DIFFERENT ENERGY: PROTEIN RATIO ON COMMERCIAL LAYING HENS' PERFORMANCES IN THE FIRST HALF OF LAYING PERIOD

Džomba E., Čengić-Džomba S., Muratović S., Hadžić Dž.

University of Sarajevo, Faculty of Agriculture and Food Sciences, Sarajevo, Bosnia and Herzegovina

Summary

An experiment was conducted to evaluate effect of different dietary levels of energy and protein on commercial laying hen's performance. A hundred twenty Lohmann Brown hens in the first half of production period (30 weeks old) were distributed in a completely randomized experimental design with 2 × 3 factorial arrangement. The first factor was dietary energy at levels of 11.7 and 12.5 MJ ME/kg feed and second one was dietary protein at levels of 16%, 17% and 18% of CP achieving 6 treatments with 5 replications of 4 birds each. The experiment lasted for 6 weeks. Hens performances (egg production, weight of egg, egg mass, feed intake, feed conversion ratio and mortality of hens) and egg structure (albumen, yolk and shell proportion, total egg solids) were evaluated. Increased level of protein has positive effect ($P<0.05$) on egg weight and albumen proportion in egg. Feed intake decreased and yolk proportion increased at higher energy level in dets. Significant dietary ME X CP interaction on feed intake, feed conversion as well as albumen and yolk proportion were found.

Key words: energy and protein, laying hens, performances, egg components

FFECTS OF DIETARY OREGANO ESSENTIAL OIL ON PERFORMANCE AND EGG QUALITY OF LAYING HENS KEPT IN FURNISHED CAGES

Demirel R., Denli M.

Dicle University, Agricultural Faculty, Department of Animal Science, Diyarbakir - Turkey

Summary

This study was carried out to investigate the effects of dietary oregano (*Origanum vulgare*) essential oil on layer hen performance, egg production, egg and shell quality produced by laying hens kept in furnished cage systems. Three hundred Atak-S laying hens 31 week old were allocated into two groups: control (NC; basal diet) and oregano essential oils (OEO; basal diets plus 150 mg kg^{-1} oregano essential oils) for 24 weeks. The supplementation of OEO significantly increased the egg weight at weeks 31 to 42 and 31 to 54 and improved feed conversion ratio (FCR) throughout the trial ($P<0.05$). However, hen day egg production, feed consumption and other egg quality parameters (egg shape index, albumen index, yolk index, shell weight rate and shell thickness) were not affected by the dietary treatment ($P>0.05$). In conclusion, our data suggested that the dietary supplementation of OEO may show positive effect on egg weight and FCR but did not affect egg quality parameters of hens housed in furnished cages.

Key words: Egg quality, furnished cage, laying hens, oregano essential oil, performance

EFFECTS OF DIFFERENT AMINO ACID SOURCES ON BROILER PERFORMANCE AND CARCASS QUALITY

Demirel R.[1], Denli M.[1], Alkan C.[2]

[1]Dicle University, Faculty of Agriculture, Dep. of Animal Science, Diyarbakır - TURKEY
[2]Ministry of Agriculture and Forestry, Mardin - TURKEY

Summary

The aim of the study was to evaluate the effects of proposed 2 different doses (1.0 and 1.25 g/kg feed) of natural herbal extract as methionine source instead of synthetically produced DL methionine (1 g/kg feed) on feeding performance and relative organ weights. In the study, day old total 312 male Ross 308 broiler chicks were used as animal material for 6 weeks of experimental period. Trial was arranged according to Completely Randomized Design, containing 3 groups. During feeding period, feed and water were supplied as ad libitum. At the end of the study, there were no statistically significant differences among groups for live weight gain, feed intake, feed conversion ratio values, gizzard, carcass and abdominal fat weights ($P>0.05$). However, there were statistically significant differences among groups for relative intestine and liver weights were found higher in synthetic DL- methionine containing group ($P<0.05$). There were statistically significant differences only between herbal extract methionine containing groups for relative spleen weights ($P<0.05$).

Key words: Feeding performance, broiler, synthetic methionine, relative organ weight

POLYMORPHISMS OVINE PRION PROTEIN (PRP) GENE IN THE PRAMENKA SHEEP BREED POPULATION(S) IN BOSNIA AND HERZEGOVINA - KUPRESKI STRAIN

Zecevic E., Dokso A., Rustempasic A., Brka M.

University of Sarajevo, Faculty of Agriculture and Food Sciences, Sarajevo, Bosnia and Herzegovina

Summary

Transmissible spongiform encephalopathy (TSE) is a group of diseases that affects nervous system, and which leads to death. Scrapie is an infectious disease of sheep and goats that belongs to this TSE group and with always fatal outcome. The putative infectious agent is the host-encoded prion protein (PrP) and it appears that the development of scrapie in sheep is closely related to polymorphisms in the host PrP gene. The aim of this study was to investigate three well-known polymorphisms in exon 3 of the PrP gene (on chromosome 13) that have a clear and significant effect on scrapie in sheep (at codons 136, 154 and 171), but also to investigate four other polymorphisms in exon 3 (at codons 145, 185, 231 and 237) that are undefined yet, but might have some effect on disease. The study was performed on the Bosnian sheep – Pramenka breed, Kupreski strain from central Bosnia. Genomic DNA was isolated from venous blood and then a 628 bp long DNA fragment from exon 3 was amplified using the PCR method. The results from this study indicate the presence of nine different genotypes associated with susceptibility of scrapie in investigated Bosnian sheep population(s). Five haplotypes were found.

Keywords: PrP, transmissible spongiform encephalopathy, scrapie, sheep

POLYMORPHISM OF PRP GENS IN THE POPULATION OF CHAMOIS IN THE AREA OF BIOKOVO - REPUBLIC OF CROATIA

Zecevic E., Dokso A., Rustempasic A., Brka M.

University of Sarajevo, Faculty of Agriculture and Food Science, Sarajevo, Bosnia and Herzegovina

Summary

Transmissible Spongiform Encephalopathies (TSEs) are a group of contagious neurodegenerative diseases that attack neural tissue by the formation of aggregates of prion particles in it. The final outcome of these diseases is lethal. Causative agent is prion, a cellular glycoprotein which have two forms, not contagious with the α - projection, denoted PrPC and infectious with the β - folded plate and labeled PrPSc. This disease is characteristic for many mammals and humans also. Research has shown that there are genetic predispositions to disease or resistance to it. In the case of goats, various codons that may be associated with disease resistance are reported in the literature, mostly for codon 146. In the study of polymorphisms in chamois, the same information as for goats was used. The genomic DNA was used in the study, which was isolated from the full blood of animals and was subjected to a polymerase chain reaction with specially designed primers. The populations of the chamois have shown that the investigated population is monomorphic when it comes to PrP gene.

Keywords: Chamois, PrP gene, Scrapie

BOTTLENECK ANALYSIS OF TURKISH AND ALGERIAN SHEEP BREEDS USING MICROSATELLITE MARKERS

Ata N.[1], Ameur Ameur A.[2], Yilmaz O.[1]

[1]Aydin Adnan Menderes University, Faculty of Agriculture, Department of Animal Science, Aydin, Turkey
[2]University of Tlemcen, Department of Biology, Laboratory of Physiopathology and Biochemistry of Nutrition, Tlemcen, Algeria

Summary

The present study was performed to reveal genetic diversity and bottleneck of Turkish and Algerian autochthonous sheep breeds using fifteen microsatellites marker recommended by FAO (2011). Animal material for the study was consisted of 180 head sheep raised in different location in Turkey and Algeria. A total of 349 alleles were detected from fifteen markers studied. The mean number of alleles (23.26), observed heterozygosity (0.76) and polymorphic information content (0.89) findings indicated that noticeable genetic variability in sheep population studied. Fourteen out of the sixteen microsatellite markers studied had a positive FIS value. The mean value of FIS was 0.061. The infinite allele model (IAM), two-phase mutation model (TPM) and stepwise mutation model (SMM) in the Bottleneck software were used to check genetic bottleneck. The L-shaped curve obtained from analyze indicates absence of bottleneck in studied sheep population raised in Turkey and Algeria. Consequently, it can be said that these results will help to develop conservation and breeding strategies for the sheep population.

Keywords: Genetic diversity, Genetic resource, Microsatellite

THE VARIATION OF AIR TEMPERATURE, HUMIDITY, AND WILD BOAR POPULATION IN HUNTING AREA IN EASTERN CROATIA IN PERIOD 2008-2018

Gavran M., Gregić M., Gantner V.

Josip Juraj Strossmayer University of Osijek, Faculty of Agrobiotechnical Sciences Osijek, Osijek, Croatia

Summary

Climate change drives population growth of wild boar directly by relaxing the negative effect of cold winters on survival and reproduction, and indirectly by increasing food availability. Air temperature is one of the main climatic elements when observing the climate of an area. Furthermore, humidity is an important factor for normal life of wild animals. Considering the great importance of the wild boar population in Croatia, the aim of this study was to determine the relationship between weather conditions and population size (regarding the categories: offspring, young, middle-aged, and mature) of wild boar population in hunting ground in Eastern Croatia during the analysed period from year 2008 to year 2018. Based on the conducted research following could be pointed out: during the analysed period from year 2008 till year 2018 the mean yearly air temperature varied in interval from 11 – 13°C, during the analysed period from year 2008 till year 2018 the mean yearly humidity varied in interval from 76 – 84 %, the lowest total number of offspring was determined in year 2017. Since the offspring are extremely susceptible to inadequate environmental conditions especially low temperature the decrease of boar population could be expected during the period characterised by extreme environmental conditions.

Key words: wild boar, population, air temperature, humidity

DETERMINATION OF MEAT QUALITY IN EXTENSIVELY REARED AKKARAMAN SHEEP BREED

Engin Tüzün A.[1], Yılmaz O.[2]

[1]Aydin Adnan Menderes University, Koçarlı Vocational High School, Aydin, Turkey
[2]Aydin Adnan Menderes University, Faculty of Agriculture, Department of Animal Science, Aydin, Turkey

Summary

The aim of the current study was to examine the effect of breed on meat quality of Akkaraman sheep breed reared in extensive production systems in Turkey. Animal material for the study consisted of 32 male lambs belonging to Akkaraman sheep breed in three and six month age groups raised solely on pasture after weaning. Post weaning 16 of each animal were slaughtered at 90 days and 18 of each animal was slaughtered at 180 days of age. The meat quality factors such as cooking loss and shear force were determined instrumentally on the *M. longissimus dorsi* (MLD) and *M. semitendinosus* (MST). Some muscle characteristics belong to *M. longissimus dorsi* (MLD) such as backfat thickness, muscle depth, muscle width and muscle area were determined in two different age group. Fatty acid composition were determined only in *M. longissimus dorsi*. The effect of age and muscle type on cooking loss and shear force were significant ($P < 0.01$). Muscle area in 3 and 6 month old lambs were 9.72 and 15.95 cm^2, respectively, while muscle depth for the same ages were 3.24 and 3.88 cm, respectively. Lambs with three months of age group showed slight superiority in terms of muscle area, muscle depth and muscle width in Musculus longissimus dorsi (MLD) samples. Monounsaturated fatty acids (MUFAs) composition was significantly influenced by age differences while conjugated linoleic acid (CLA), saturated fatty acids (SFAs) and polyunsaturated fatty acids (PUFAs) was not statistically significant on the age differences. The study results clearly showed that age significantly affects some of muscle fatty acid composition and muscle characteristics.

Keywords: Lamb, Fatty acids, MLD

DEVELOPMENT AND SELECTION OF OPTIMAL STATISTICAL MODELS TO EVALUATE THE EFFECT OF MICROCLIMATE PARAMETERS ON THE VARIABILITY OF PRODUCTION TRAITS IN DAIRY COWS

Vučković G.[1], Gavran M.[2], Gregić M.[2], Mijić P.[2], Gantner R.[2], Brka M.[3], Gantner V.[2]

[1]Rinderunion Baden-Württemberg, Herbertingen, Germany
[2]Josip Juraj Strossmayer University of Osijek, Faculty of Agrobiotechnical Sciences Osijek, Department for animal production and biotechnology Osijek, Croatia
[3]University of Sarajevo, Faculty of Agriculture and Food Sciences, Department for Animal Breeding, Bosnia and Hercegovina

Summary

Currently we are living and producing in the world characterized by a climate change. For agriculture and livestock production, this change means, in most cases, deterioration of the environmental effect in numerous regions globally and consequently significant effect on livestock production in the world. Modern livestock production, most frequently implies high production per animal, meaning high milk production per cow in terms of dairy cattle production. The increase of production makes cows more susceptible to heat stress, meaning that heat stress will become an acute problem regardless of climate changes, that will only further emphasize this problem. High-producing dairy cows lose the ability to regulate their body temperature when the ambient temperatures reach 25-29^{o}C. Furthermore, the intensive genetic selection for high milk production resulted in changed thermoregulation physiology meaning that the high-producing cows have larger frames and consequently larger gastrointestinal tracts that enable them to digest more feed. This creates more metabolic heat and reduces the ability of cows to regulate normal temperature at heat stress conditions. Finally, by increase of milk yield, feed intake and metabolic heat, the thermoneutrality of animal shifts to lower temperatures. Accordingly, to many researches, heat stress environment induces reduction in dry matter intake, milk production and reproductive performances. Also, heat stress conditions affects milk composition, somatic cell counts (SCC) and mastitis frequencies.
Since Pannonian region is characterized by the high prevalence of heat stress days, mostly during the summer season, the aim of this paper was to develop and select optimal models for evaluation of the effect of microclimate parameters on the variability of production traits in dairy cows.

Key words: statistical modeling, microclimate, production traits, dairy cattle

PERSISTENCY OF THE EFFECT OF HEAT STRESS IN SIMMENTAL COWS IN EASTERN CROATIA

Gantner V.[1], Kučević D.[2], Gavran M.[1], Gantner R.[1], Gregić M.[1], Bobić T.[1], Šperanda M.[1], Brka M.[3]

[1]Josip Juraj Strossmayer University of Osijek, Faculty of Agrobiotechnical Sciences Osijek, Department for animal production and biotechnology Osijek, Croatia
[2]University of Novi Sad, Faculty of Agriculture, Department of Animal Science, Novi Sad, Serbia;
[3]University of Sarajevo, Faculty of Agriculture and Food Sciences, Department for Animal Breeding, Bosnia and Hercegovina

Summary

Aiming to determine the persistency of effect of heat stress in Simmental cows reared in Eastern Croatia regarding the parity and susceptibility to heat stress, 539,993 test-day records from 59,821 cows collected in the period from January 2005 to December 2012 were analysed. The cows with determined statistically significant decrease in daily milk production at set temperature-humidity index (THI) threshold value (68 and 72) were included in the further analyses. The persistency of heat stress effect was defined as the drop in daily milk traits in the subsequent milk recordings (1st and 2nd) after the heat stress. The obtained results indicate that cows heat stressed at lower THI threshold value had higher drop in daily milk yield in subsequent milk recordings. Furthermore, cows in first parity experience higher drop comparing to older cows. The negative effect of heat stress on daily milk contents that existed in all cows was more pronounced in the 2nd milk recording. Finally, the lower was THI threshold value (cows more susceptible to heat stress), the stronger and more persistent was heat stress effect. Given the very likely increase in the frequency of days with heat stress in the future, it is necessary to develop a proper mitigation strategy for dairy cattle production.

Key words: daily milk production, Simmental cows, heat stress, persistency

EXTERIOR CHARACTERISTICS OF DUBIAN PRAMENKA SHEEP ON AREA NORTH HERZEGOVINA

Dokso A., Zečević E., Rustempašić A.

University of Sarajevo, Faculty of Agriculture and Food Sciences, Sarajevo, Bosnia and Herzegovina

Summary

The aim of the present research is to study the external features and the morphological parameters of the Dubian pramenka sheep. Research were carried out on 95 adult sheep (105 ewes and 30 rams) on area north Herzegovina, municipality Konjic. In order to establish the main features of the exterior, basic body measurements were taken: the height of withers, the body length, the chest depth and circumference of the chest. The average height of withers of adult Dubian sheep in this research was 74.57 cm, the body length 79.37 cm, the depth of chest 33.77 cm and the circumference of the chest 110,11 cm for ewes and, 84.13 cm, 88.53 cm, 37.63 cm and 117.43 cm for rams. Data were analyzed using procedure UNIVARIATE of SAS statistical package. The results obtained show somewhat higher values than the most of previous research on this breed, which can be explained by good breeding and environmental conditions. To obtain a more complete picture of the exteriors characteristics of Dubian sheep, it is necessary to continue the research, including a significantly larger number of animals with the wider breeding area.

Key words: Dubian pramenka sheep, features, morphological parameters.

KEEL BONE DAMAGE IN LAYING HENS REARED IN ENRICHED CAGES AND AVIARY SYSTEMS

Đukić Stojčić M.[1], Perić L.[1], Spridonović S.[1], Dedousi A.[2], Sossidou E.[2]

[1]University of Novi Sad, Faculty of Agriculture, Novi Sad, Serbia
[2]Veterinary Research Institute / Hellenic Agricultural Organization–Demeter, Thessaloniki, Greece

Summary

New modified housing systems for laying hens have been introduced in the EU countries since 2012, when Directive 1999/74/EC came to force. However, transition to the new systems uncovered some new problems, such as keel bone damage (KBD) in laying hens. The term 'keel bone damage' includes the deviations and fractures of the keel bone which could be painful for the hen and thus could endanger welfare and reduce productivity (Harlander et al., 2015). High frequency of KBD in the commercial systems represents one of the greatest challenges which the modern poultry industry faces (FAWC, 2010, 2013). Moreover, this phenomenon is still rather unknown, even among scientific and professional community and there is no sufficient information about KBD not only in Serbia but in all countries from the region, where the Directive 1999/74/EC is still not effective.

The research was carried out on Lohmann brown laying hens in the middle of the production cycle in two different production systems (enriched cages and aviary system) at the same farm. At 40 weeks of age, 100 hens were randomly selected from each housing system and were inspected for KBD. The prevalence of KBD was assessed by using the palpation technique of Wilkins et al. (2004). Palpation was performed by running fingers alongside and over the keel bone. It was only determined whether KBD was present (fracture, deformation, deviation) or not.

The results of conducted monitoring show presence of KBD in both housing systems. The occurrence of KBD in the fully equipped enriched cages was 29,2%, where 4,2% had both deviation and KF (keel fracture). In aviary system occurrence of KBD was very high (43,6%), where 27.3% of the hens had deformation, 10.9% had fractures and 5.5% had both deformation and fractures. It can be assumed that a higher percentage of KF in the cage system is indirectly conditioned by the complicated maintenance of the balance and movement in this system. The high prevalence of keel deviation in fully equipped enriched cages can be the result of a long perch on metal pads.

Because palpation technique is not the best method to evaluate whether fractures are present on the keel bone or not, further research is needed on the same hens using x-ray, or ultra sound methods to determine the presence of fractures, and in which part of the keel bone there are. Generally it can be concluded that laying

hens reared in enriched cages have less KBD problem then laying hens from aviary system.

Key words: keel bone damage, laying hens, housing systems

USING OF BLACK SOLDIER FLY (*HERMETIA ILLUCENS*) LARVAE MEAL IN FISH NUTRITION

Čengić-Džomba S., Džomba E., Muratović S., Hadžić DŽ.

University of Sarajevo, Faculty of Agriculture and Food Sciences, Sarajevo, Bosnia and Herzegovina

Summary

Fish consumption is expected to increase in future due to increase in demand for animal products. Fish meal is a major ingredient in *Salmonidae* diets and it considerably increases the cost of fish feed. Replacing fish meal with plant protein was not so successful, primarily due to low biological value of plant protein (composition and ratio of amino acids). Recently, many researchers started to look into the possibility of using insects in fish nutrition. EU Regulation No 813/2017[1] approved the use of the following seven insects as animal feed: Black soldier fly – BSF (*Hermetia illucens*), Common housefly (*Musca domestica*), Banded cricket (*Gryllodes sigillatus*), Field cricket (*Gryllus assimilis*), House cricket (*Acheta domesticus*), Lesser Mealworm (*Alphitobius diaperinus*) and Yellow Mealworm (*Tenebrio molitor*). Among them, use of black soldier fly shows the most promising results. BSF contains between 40 and 45% of crude protein and even more than 40% of ether extract - depending on the substrate it was reared on, and stage in the life cycle. Protein from BSF larval meal contains favourable composition of amino acids for fish nutrition. Additionally, fatty acids composition of BSF that depends on the growing substrates can be adjusted to have higher content of ALA, EPA and DHA, and lower content of SFA. The literature data about replacing fish meal with BSF larval meal is controversial. What appears to be the best is to replace up to 50% of fish meal with BSF larval meal in rainbow trout nutrition, as this shows no adverse effect on fish performances, including weight gain rate, specific growth rate, protein efficiency ratio, and protein productive value.

Key words: insects, fish meal replacing, black soldier fly larval meal

OCCURRENCE AND CHARACTERISTICS OF DEEP PECTORAL MYOPATHY IN BROILER CHICKENS

Stojanović S., Žikić D., Uśćebrka G.

University of Novi Sad, Faculty of Agriculture, Novi Sad, Serbia

Summary

Deep pectoral myopathy (DPM) is a condition characterized by necrosis and structural changes in deep pectoral muscle in broiler chickens. Although the occurrence of DPM is increasing in modern broiler production, there is not enough findings about incidence of DPM in Balkan region and surrounding area. The aim of this paper was to examine the occurrence and characteristics of DPM in broilers from several farms located in Bačka District of the province of Vojvodina. After the chickens were collected from farms, at the slaughter line carcasses were examined for the existence of DMP. Carcasses in which DPM was observed were classified into 4 stages (DPM 1, DPM 2, DPM 3 and DPM 4) depending on the degree of myopathy. Of the total number of the examined chickens, DPM 1 was detected in 7.4% of chickens, DPM 2 in 5.3% of chickens, DPM 3 in 1.6% of chickens and DPM 4 in 1.1% of chickens. From samples of deep pectoral muscle from each of the stages of DPM, histological preparations were made, and microscopic characteristics of structural changes detected in each stage were described. Obtained results indicate that DPM was highly presented in examined chickens, and each stage of myopathy was characterized by specific changes in macroscopic and microscopic structure of muscle tissue.

Key words: broiler chickens, deep pectoral myopathy factors

BREEDING PROGRAM IN ORGANIC DAIRY CATTLE FARMING

Štrbac Lj., Šaran M., Čobanović K., Krstović S., Trivunović S.

University of Novi Sad, Faculty of Agriculture, Department of Animal Science, Novi Sad, Serbia

Summary

The objective of the study is to analyse the current situation in breeding for organic dairy cattle farming, including the literature reviews as regards breeding goals and use of reproduction technologies. General conditions for animal breeding in organic farming are defined by the EU Regulations on organic farming. According to these regulations a decrease of the proportion of artificial insemination is desired. Based on the results of the different studies, three distinct options are formulated for breeding in organic dairy farming: (1) use of adapted conventional breeding, (2) a separate breeding program and (3) a breeding system based on natural mating. As regards the overall breeding goal, significantly more importance was placed on functionality than on production and conformation traits. However, most often the organic sector still heavily depends on conventional breeding programs. In Serbia, organic dairy cattle breeding focusing mainly on the Holstein Friesian breed and use conventional methods of breeding i.e. use AI bulls from conventional breeding schemes. The largest organic dairy farm is located in Vojvodina. The number of animals is about 2.000, including about 900 dairy cows. Organic dairy cattle breeding in Serbia are facing with different problems. For example, space and the possibility of animals moving freely in pasture that meet the requirements of organic production. Problem is food that is must be produced organically. Also, the population in Serbia is still not sufficiently educated in the field of organic production, there is unfavourable structure of the farms (a large number of small farms, which do not cooperate; aging of the farmers; the traditional approach to production; crisis of the livestock sector), as well as inadequate application of environmental marketing, insufficiently aware and informed consumers, on the one hand, and insufficiently wide assortment, quantity of products and steady offer, on the other.

Key words: breeding program, dairy cattle, organic production

BLOOD ACID-BASE BALANCE OF ISTRIAN GOATS

Antunović Z.[1], Klir Ž.[1], Šerić V.[2], Zmaić K.[1], Novoselec J.[1]

[1]Josip Juraj Strossmayer University of Osijek, Faculty of Agrobiotechnical Sciences Osijek, Osijek, Croatia
[2]Clinical hospital Osijek, Osijek, Croatia

Summary

The aim of the research was to determine of acid-base balance in the blood of Istrian goats during summer season and compare with the other breeds of goats in Mediterranean environment. The research included 21 Istrian goats average age 4 years. Feeding of goats was with pasture and when returned to stable were fed a grain mixture (0.3 kg/goat/day) and meadow hay (ad libitum). In the blood of goats concentrations acid-base indicators (blood pH, BE(efc), blood gas analysis: partial pressure of carbon dioxide (pCO_2), partial pressure of oxygen (pO_2), total pressure of carbon dioxide (tCO_2), as well as electrolytes: Ca^{2+}, Na^+, K^+, Cl^- and HCO_3^- - bicarbonate) as well as total protein and albumin concentration were determined. Afterwards, anion gap (AG), strong ion differences (SID), z-values, weak anions and cations (ATOTtp and ATOTalb), strong ion gap (SIGtp, SIGalb) and unmeasured anions (XA) were estimated. Indicators of acid-base balance in blood of Istrian goats did not differ compared to reference values, except blood pH value (7.32) which was at lower limit of reference values, and higher values of pCO_2 and tCO_2 (11.49 kPa and 28.8 mmol/L) possibly related to pulmonary ventilation due to higher air temperature during summer season.

Keywords: Acid-base status, Blood, Istrian goat

ANALYSIS OF SLEEPING BEHAVIOUR IN DAIRY COWS

Gavran M., Mijić P., Steiner Z., Gantner V.

University Josip Juraj Strossmayer in Osijek, Faculty of Agrobiotechnical Sciences Osijek, Osijek, Croatia

Summary

Sleep is a naturally-occurring, reversible, periodic and recurring state in which consciousness and muscular activity is temporarily suspended or diminished, and responsiveness to outside stimuli is reduced. Many human sleep studies have been conducted so far, while animal sleep has not yet been fully explored. Precisely, very little is known about sleeping and resting in dairy cattle, but they do lie down for up to 10-14 hours per day, standing up every few hours, eating, stretching and then lying back down again. Cows need time for eating, drinking, milking, and also for performing social behaviour. Some studies shown that the total amount of sleep and distribution of sleep over 24 hours vary depending on age, health status, pregnancy and lactation. Used method was non-invasive electrophysiological technique for recording sleep in dairy cows for investigation variations in sleep pattern. Changes in the environment also affect on distribution of sleep and behaviour in cows, such as moving cows between groups consequently will be reflected in lying time and feeding behaviour. Moreover, lack of lying and sleep has influence on production and welfare of dairy cows. The aim of this study is to review the importance of lying behaviour and sleep and their impact on dairy cows production and welfare.

Key words: dairy cows, sleeping, behaviour

DAIRY CATTLE WELFARE IN TERMS OF HEAT STRESS

Gavran M., Mijić P., Đidara, M., Gantner V.

University Josip Juraj Strossmayer in Osijek, Faculty of Agrobiotechnical Sciences Osijek, Osijek, Croatia

Summary

Heat stress has significant effects on milk production and composition as well as on cattle welfare. Cows with high production capacity have a faster metabolism, produce more heat in the body and more easily tolerate lower temperatures, while high temperatures can easily cause heat stress. Heat stress is state of an organism exposed to external or internal thermal factors whereby the homeopathic systems of the body are unable to resist their harmful effects. Heat stress directly or indirectly affects the physiology, reproduction, health, feeding, production and behaviour of animals and it can cause even death. Negative effects of heat stress on animal welfare can be observed in changes in animal behaviour. Affected animals are also passive, spend less time in social interactions and less time eating. These factors will certainly lead to drop in production. Therefore, it is necessary to study the welfare of the animal through the mental state of the animal, such as frustration or absence of pain, not just through physiological measures. The aim of this study was to review the connection between the heat stress environment and dairy cows' welfare.

Key words: heat stress, dairy cattle, welfare, behaviour

THE EFFECT OF HORSE AGE AND COMPETITIVE SEASON ON STRESS INDICATORS IN JUMPING HORSES IN RUNNING TRACK

Gregić M.[1], Baban M.[1], Mijić P.[1], Bobić T.[1], Dokić D.[2], Brka M.[3], GantnerV.[1]

[1]Josip Juraj Strossmayer University of Osijek, Faculty of Agrobiotechnical Sciences Osijek, Department for animal production and biotechnology Osijek, Croatia
[2]Erdut Municipality, Dalj, Croatia;
[3]University of Sarajevo, Faculty of Agriculture and Food Sciences, Department for Animal Breeding, Bosnia and Hercegovina

Summary

Aiming determination of the effect of horse age and competitive season (May, July, September) on stress indicators in jumping horses in running track, research was performed on 14 studs (7 younger, and 7 older) trained and bred in the same conditions. The stress indicators (heartbeats, cortisol, glucose, and lactate concentrations in saliva) were measured or sampled before, during and at the end of the training - running track. The significance of the differences in stress indicators due to horse age regarding the competitive season was tested by t-test (PROC GLM, SAS/STAT). Based on conducted research it could be concluded that all analyzed stress indicators: heartbeats, and cortisol, glucose, and lactate concentrations in saliva, during the entire competitive season, were higher in younger (less experienced) comparing to older (more experienced) horses. Furthermore, all analyzed stress indicators were highest in July that is in the peak of competitive season. Since every physical activity causes a certain amount of stress, monitoring of stress indicators, especially heart-beats could be used for routine evaluation of horse preparedness for a particular activity.

Key words: jumping horses, running track, stress indicators

T-STANDPOINT ASSISTS THE BIRD PREDATION OVER FIELD RODENTS IN LUCERNE

Simunić A. M.[1], Gantner R.[2], Bošković I.[2], Bukvić G.[2], Gantner V.[2]

[1]student of University Josip Juraj Strossmayer in Osijek, Faculty of Agrobiotechnical Sciences Osijek, Osijek, Croatia
[2]University Josip Juraj Strossmayer in Osijek, Faculty of Agrobiotechnical Sciences Osijek, Osijek, Croatia

Summary

Field rodents, when too abundant, can cause considerable economic losses in perennial crops, especially lucerne. Predatory birds can provide a natural control of field rodent populations since the field rodents are their natural pray. However, the modern agricultural landscapes of forage enterprises usually provide few or no natural standpoints for predatory birds for ravening the pray on the ground. According to the old farmers of east Croatia, T-standpoints" installed into lucerne were traditional implements easing the bird predation over field rodents. Aim of this study was to check whether the T-standpoints really are an appropriate installations for predatory birds ravening the pray on the ground or not. Research comprised the installation of two T-standpoints at approximately 1 ha of lucerne crop in the village Ernestinovo in Croatia and monitoring of predatory birds landing to the installations, ravening the pray and landing to the ground during 10 months of observation. The research has confirmed that predatory birds (Buteo buteo and Falco tinnunculus) used the installed T-standpoints for ravening and occasional landing to the ground, probably for catching a pray. Approximately 13% of the lendings to the T-standpoints ended with a landing to the ground and some prey attack. During 2018, the highest attendance at the T-standpoints and the highest number of landings were during September and October, when there were expected the highest field rodents population densities within low plant cover on alfalfa. During 2019, an even higher attendance of T-standpoints was observed during March, April and June, but with a smaller average number of landings per observation day, probably due to a decrease in the rodent population following the loss of individuals during the winter. During May, there was a very low attendance and number of attacks per day of observation, probably due to very rainy weather.
Key words: field rodents, predatory birds, natural control

THE EFFECT OF DIETARY SUPPLEMENTATION OF RUMEN PROTECTED GLUCOSE ON METABOLIC PARAMETERS AND MILK QUALITY IN DAIRY COWS

Benak S.[1], Đidara M.[2], Gantner V.[2], Šperanda M.[2]

[1]Belje plus - a feed factory, Darda, Croatia;
[2]Josip Juraj Strossmayer University of Osijek, Faculty of Agrobiotechnical Sciences Osijek, Osijek, Croatia.

Summary

Blood glucose concentrations in high productive dairy cows is a master regulator of hormones and metabolites which are in relation with milk production, reproductive performances and health. Low blood glucose postpartum is caused by inadequate glucose entry rate relative to whole-body demand as opposed to the alternative possibility that postpartum cows have a lower regulatory set point for blood glucose. The aim of this research was to evaluate the addition of rumen protected glucose on metabolic and milk parameters in dairy cows at the peak of lactation. Twenty-four dairy cows average 52.83 (SD=28.94) days (control) and 54.58 (SD=27.78) days in milk (experimental) were used for the dietary trial with rumen protected glucose addition in concentration of 200 g/day/cow. Biochemical parameters glucose, total protein, albumin, urea, insulin-like growth factor-1 (IGF-1), non-esterified fatty acids (NEFA), β-hydroxybutyrate, (BHB) and alkaline phosphatase (ALP) were measured at the beginning of the trial and 21st day after dietary treatment. Parameters for milking control were daily milk yield (DMY), milk fat content (MFC), milk protein content (MPC), urea in milk, lactose in milk, fat/protein index and somatic cell count (SCC). No significant differences of biochemical parameters and milk performances between control group and the experimental group were found. Feeding bypass glucose showed 57% reduction in the number of milk somatic cells in the milk of multiparty cows at the end of the experiment. Dietary addition of rumen protected glucose in dosage of 200 g/day/cow in the period of lactation peak showed no effect on milk production and metabolic profile.

Keywords: rumen protected glucose, biochemical parameters, milk performances, dairy cow

APPLICATION OF ESSENTIAL OILS AND PROBIOTICS IN CALF FEEDING

Steiner, Z., Ronta, M., Gantner, V., Gavran, M., Novoselec, J., Klir, Ž., Mamić, F.

Josip Juraj Strossmayer University of Osijek, Faculty of Agrobiotechnical Sciences Osijek, Osijek, Croatia

Summary

The aim of the study was to determine the effect of the addition of essential oils and probiotics in the calves feed. The study was conducted on 70 male calves, crossbred Belgian blue cattle and Simmental. The calves are divided into two groups of 35 calves of an average age of 60 days previously weighed and balanced by body weight. The control group was fed a ration without supplements, while essential oils and probiotics were added to the ration of the experimental group. The duration of the study was 77 days. Production traits, i.e. body weight, average daily gain and food conversion, were monitored. The results obtained for body weight were higher in the experimental group than in the control group (5397: 4918 kg). The results of the average daily gain were also higher in the experimental group than in the control group (0.62: 0.78 kg). The feed conversion ratio was lower in the experimental group compared to the control (2.10: 1.56 kg / kg). Based on the results it can be concluded that the addition of essential oils and probiotics in calves ration has a positive impact on the monitored production traits.

Keywords: Probiotics, essential oils, natural supplements, calves, production traits

AGRICULTURAL ECONOMICS

EXPLORING THE LINKS BETWEEN FARMERS' INTENTION TO APPLY FOR RURAL DEVELOPMENT PROGRAM AND NETWORKS

Martinovska Stojcheska A., Kotevska A, Tuna E., Simonovska A.

University Ss Cyril and Methodius in Skopje, Faculty of Agricultural Sciences and Food, Skopje, North Macedonia

Summary

The rural areas in North Macedonia encompass around half of the territory and population in the country, where agriculture is core activity and source of income, with lack of other employment opportunities. The rural development program (RDP) budget is not fully utilized. Informal networks among rural population are still the most valuable source of social capital and information exchange, whereas formal networks, such as associations or cooperatives, are still lacking to ensure their sustainable and functional role. This paper explores the factors influencing farmers' intention to apply for RDP, with an emphasis on network membership. The Theory of Planned Behavior and Social Capital Theory are used as framework. A direct survey on 296 family farms was carried out in 2014. The study is conducted using multivariate statistics, structural equation modelling and social network analysis. The model explains farmers' mid-term intention to use RDP. Farmers' attitudes and perceived behavioral controls, as well as network activity and participation, significantly influence the intention to apply for RDP funds. Network participation, as well as education levels and investment tendency are positively related to the intention to use RDP. These findings could be reflected in appropriate measures to encourage farmers' participation in institutionalized networks, thus in addition to their primary aim, to increase the RDP effectiveness as means of providing better opportunities and quality of life in rural areas.

Keywords: North Macedonia, Social Capital Theory, Theory of Planned Behaviour.

STAKEHOLDER AND SOCIAL NETWORKS: BASIS FOR DEVELOPING PASTURE MANAGEMENT STRATEGIES

Tuna E., Martinovska Stojcheska A.

University Ss Cyril and Methodius in Skopje, Faculty of Agricultural Sciences and Food, Skopje, North Macedonia

Summary

Pastures in Shara Mountain are managed by the Public enterprise for management of Pastures (PEMP) in the Republic of North Macedonia. The national pasture development strategy is still not ascertained, thus many structural questions remain unsolved. Strengthening the capacities for pasture management is very significant, hence the need to identify all relevant stakeholders on horizontal and vertical level that can contribute in the proper information diffusion and raise public awareness among all affected actors in the pasture management network. In this respect, the aim of this paper is to describe certain aspects of social complexity of pasture management structures in order to provide grounds for developing sustainable management strategy. Combining methods such as social network analysis (SNA) with stakeholder analysis can often contribute to the richness in the analysis and add to the understanding of relations. Therefore, the analysis primarily aims to identify the stakeholders in the context of mountain grazing areas of Shara Mountain, but also present the relations and information sharing network of the actors at regional and local levels on horizontal level, and the vertical and horizontal interplay between the actors at different levels such as their institutional and commercial associates. Mapping each stakeholders' positions and roles in the communication network and information transfer is expected to provide a base for developing strategy tailored to each stakeholders' future involvement in the pasture management system.

Keywords: information, relations, pasture management, stakeholder, social networks, Shara Mountain.

ECONOMIC PERFORMANCES OF URBAN FARMS IN RUHR METROPOLITAN REGION - FINDINGS FROM A CLUSTER ANALYSIS AND CLASSIFICATION TREES

Pölling B.[1], Lorleberg W.[1], Mergenthaler M.[1], Sroka W.[2]

[1]Fachhochschule Südwestfalen, Department of Agriculture, Soest, Germany
[2]University of Agriculture in Krakow, Institute of Economic and Social Science, Krakow, Poland

Summary

Urban food systems were marginalized from the perspectives of both, cities and agriculture, for a long time. Since about two decades increasing dynamism and interest in food-related issues can be detected in cities. Urbanisation is an important factor influencing agriculture. Analyses and discussions on urban farming's economics are lacking, especially in Europe. Therefore, this paper aims to get insights into the economic performances of urban farms situated in the largest German and polycentric agglomeration, Ruhr Metropolitan Region. The analysis is based on results of a survey among farm managers in the case study region, which approach the economic performance of urban farms from two different angles: farm success and business models. While the business model approach makes use of a complete linkage cluster analysis, farm success is approached with classification trees applying the three dependent variables farm business success, farm business prospect, and farm succession. Both methods show that city-adjusted farms, especially short supply chains including direct sale and tourism services, are more successful than those without city-adjustments.

Keywords: Urban farming, classification trees, cluster analysis, business model, economic performance

URBAN FARMING'S CONSUMER PREFERENCES SURVEY IN WESTERN BALKAN

Pölling B.[1], Glamočlija P.[2], Drkenda P.[2]

[1]Fachhochschule Südwestfalen, Department of Agriculture, Soest, Germany
[2]University of Sarajevo, Faculty of Agriculture and Food Sciences, Sarajevo, Bosnia and Herzegovina

Summary

The Erasmus+ project "BUGI – Western Balkan Urban Agriculture Initiatives" conducted a consumer preferences survey on urban farming in the three Western Balkan countries Bosnia and Herzegovina, Kosovo, and Montenegro. The analysis takes nearly 250 replies into account to learn about the consumers' attitude towards urban farming. Firstly, the survey provides insights on consumers' self-consumption and purchase of food as well as on exploited food purchase channels and categories. Secondly, the survey sheds light on the question whether the term "urban agriculture" resp. "urban farming" is known. Thirdly, more details on consumers' preferences related to urban farming have been collected, including types of urban farming, from which consumers would buy food products from, how the consumers' attitude is towards certain urban farming's production systems, and which kinds of products they would buy. Fourthly, the consumers' willingness to pay for urban food products is compared to the willingness to pay for food from the anonymous mass market. This study was the first of this kind, which has been conducted in the three countries of Bosnia and Herzegovina, Kosovo, and Montenegro. The findings are able to support the establishment of viable urban farming businesses and viable urban food systems as well as stronger engagements of administrations and higher education institutions to put urban farming on their agendas.

Keywords: urban farming, consumer preferences, urban food systems, Western Balkan

THE ROLE OF INTERNATIONAL TRADE IN THE CREATION OF THE SUSTAINABILITY OF AGRICULTURAL PRODUCTION - COMPARATIVE PRESENTATION OF THE FORMER YUGOSLAVIA

Dokić D.[1], Gregić M.[2], Brka M.[3], Gantner V.[2]

[1]Erdut Municipality, Dalj, Croatia;
[2]Josip Juraj Strossmayer University of Osijek, Faculty of Agrobiotechnical Sciences Osijek, Department for animal production and biotechnology Osijek, Croatia
[3]University of Sarajevo, Faculty of Agriculture and Food Sciences, Department for Animal Breeding, Bosnia and Hercegovina

Summary

Modern aspects of the business do not exclusively concern the manufacturers themselves, and today they are much more complex than before. The total quantity of agricultural products produced is placed on the market by producers if they do not use it for further reproduction. Trade enables the exchange of goods and thus makes goods widely available. International trade flows are of great importance in terms of economic and regional development. No economy can base its growth on the self-sufficiency of real and financial resources, and is therefore directed to international trade, whose final balance reflects the degree of growth and macroeconomic variables of a particular economy. The aim of the paper was to point out the importance of trade and its positive aspects to which it contributes to society. Furthermore, the example of the countries of the former Yugoslavia will show how much international trade in agricultural products contributes to economic development. An analytical model for analysing the volume of production and trade in goods through the components of imports and exports will show the value of trade between countries and how this reflects on the overall economic situation. Furthermore, the gravity model will analyse the overall geographical environment and show which multilateral factors affect the commodity exchange process.

Key words: agricultural production, trade, commodity exchange, gravity model, export, import

ANALYSIS OF CATTLE PRODUCTION IN OSIJEK-BARANJA COUNTY USING THE COBB-DOUGLAS MODEL

Dokić D.[1], Gregić M.[2], Gavran M.[2], Brka M.[3], Gantner V.[2]

[1]Erdut Municipality, Dalj, Croatia;
[2]Josip Juraj Strossmayer University of Osijek, Faculty of Agrobiotechnical Sciences Osijek, Department for animal production and biotechnology Osijek, Croatia
[3]University of Sarajevo, Faculty of Agriculture and Food Sciences, Department for Animal Breeding, Bosnia and Hercegovina

Summary

Local development is inconceivable without investment in the creation of new value. This process means an increase in production of goods and services, with simultaneous structural transformations and changes in the functioning of the local economy. The purpose of this study was to, through Cobb-Douglas's function, calculate the value of cattle production in Osijek-Baranja County, that is to show the relationship between a certain amount of labour and capital. Based on performed analysis it could be concluded that Cobb-Douglas's model of production value calculation is applicable in practice. Also, labour productivity and technological capital have been demonstrated as two parameters that affect the volume of production and by different combinations of these two parameters the volume of production can be changed. Generally speaking, it is necessary to focus on cost reduction. In this case, the Osijek-Baranja County has a lower opportunity cost in cattle production compared to other counties in the Republic of Croatia. With this, lower costs and specialization of production have a relative advantage over the competition. Greater labour costs reduce production volume and move production to other areas where the wages are lower. But also, low labour costs, although increasing the volume of production, have a disincentive effect on the labour supply, or stimulate the migration of working-age people into areas where wages are higher.

Key words: cattle production, Cobb-Douglas function, labour productivity, capital

ENTREPRENEURIAL EDUCATION SKILLS IN URBAN AGRICULTURE OF BOSNIA AND HERZEGOVINA

Mujčinović A., Čadro S., Uzunović M., Makaš M., Glamočlija P., Drkenda P.

University of Sarajevo, Faculty of Agriculture and Food Sciences, Sarajevo, Bosnia and Herzegovina

Summary

Agriculture has always been an important element of economic development of Bosnia and Herzegovina (B&H). With noteworthy trend of urbanization, urban and peri-urban areas become more important and represent a huge opportunity for business development, production of high-value products, products for niches markets, development of short supply chains, Alternative Food Networks, and the provision of services connected with agriculture. Although it has been in some form a part of the long-time tradition, urban agriculture has only begun to expand recently in B&H. Currently, there are a few incentives to stimulate the development of this field of agriculture and they are mostly driven by foreign investment. Consumer perception toward products of urban agriculture in B&H is also a field that needs special attention, while it is well known that population appreciate value-added products, consumers are generally environmentally conscious and if we take into the consideration positive effect of urban agricultural practice on the environment, it may be a good sign for stronger development of this subsector. One of the missing elements are information regarding the type of soft and hard skills, that are necessary to have in order to perform urban agriculture activities, therefore, the aim of this study is to identify a set of entrepreneurial education skills (soft and hard) that can help to perform, develop and upgrade this relatively new agro-business practice in B&H.

In order to achieve such aim, the questionnaires, previously developed and tested, in the Training Needs Analysis within the course of the Erasmus+ project Urban Green Education for Enterprising Agricultural Innovation were used. The four considered key stakeholder groups are Higher Education Institutes, Small and Medium-sized Enterprises, Non-Governmental Organizations, and Public Authorities. The results showed that capacity for teamwork, communication, self-confidence from a group of soft skills are most important, while among hard skills plant protection, communication and networking, project planning are found to be a most important.

Key words: urban agriculture, entrepreneurial skills, education, Bosnia and Herzegovina

FOOD TECHNOLOGIES

SEASONAL VARIATIONS IN DEPOSITION OF FAT IN THE BODY OF RAINBOW TROUT *ONCORHYNCHUS MYKISS* (WALBAUM 1792) AND ITS EFFECT ON YIELD AND QUALITY OF MEAT IN CAGES AT COMMERCIAL BREEDING FARM

Karahmet E., Isaković S., Muhamedagić S., Toroman A., Đulančić N.

University of Sarajevo, Faculty of Agriculture and Food Science, Sarajevo, Bosnia and Herzegovina

Summary

The aim of the experiment was to determine the effects of seasonal changes in the degree of fat deposition in various parts of the body and its impact on yield VSI (Viscero Somatic Index) of rainbow trout Oncorhynchus mykiss (Walbaum 1792), under the same conditions of feeding in cage farming systems of commercial fish farms. The task was to identify what is and what impact seasonal variation and environment on yield and quality of the meat of rainbow trout, which is fed with same nutrients to achieve a certain weight. As a basic experimental material has been used rainbow trout produced for the Bosnian and foreign markets of varying body weight: First group of fish between 150 ± 5g, group II 200 ± 5g and III group 250 ± 5g. The same is provided from the local fish farm Salakovac on the Neretva River. A total of 180 fish samples were analyzed. This test showed there were highly significant statistical differences in the content of: fat (0.000), moisture (0.000), and protein (0.000) relative to the weight of the samples. Gathering data confirmed there were statistically significant differences between the seasons March-November in fat content (0.019), and November-December (0.033). At the same time proteins showed statistically significant differences only in relation to season of March-August (0,001). The results of analysis of the value of Viscero Somatic Index (VSI) showed there is a very highly significant statistical difference in relation to season (0,000).

Keywords: fat deposition, rainbow trout, yield (VSI), seasonality, cage farming.

QUALITY OF CRAFT BEERS IN BOSNIA AND HERZEGOVINA

Jurić A.[2], Maestro D.[1],[3],[4], Čaušević, A[1], Jurišić M.[4]

[1]Institute for Public Health of Federation Bosnia and Herzegovina
[2]University of Mostar, Faculty of Agriculture and Food Technology, Mostar, Bosnia and Herzegovina
[3]University of Sarajevo, Faculty of Health Studies, Sarajevo, Bosnia and Herzegovina
[4]Association for Sanitary Engineering in Bosnia and Herzegovina

Summary

Craft beer is defined as a beer made by a brewer that is small, independent and traditional. In this Experiment, 69 beers from 15 craft breweries across Bosnia and Herzegovina were sampled in order to be quality controlled. These tests included chemical analysis (e.g. alcohol volume, sulphur dioxide, carbon dioxide, pH). In addition, later is tested if declaration is in compliance with the current legislation in Bosnia and Herzegovina. This experiment included 20 types of beers: American Pale Ale (17), India Pale Ale (12), Wheat Ale (4), Porter (4), Amber Ale (4), Red Ale (3), Hefeweisen (3), English Pale Ale (3), Belgian Blonde Ale (3), Brown Ale (2), Stout (2), Smoked (2), American IPA (2), Pilsner (2), Grodziskie (1), Dunkelweizen (1), Double Ipa + Specialty IPA: Black IPA (1), Herb (1), Witbier (1), Pumpkin (1). In results even 43 samples showed irregularities in declaration, mostly because of wrong alcohol volume specified. Due to the high sample size of craft beers tested, the results lead us to suggest with confidence that it would be out of great need to organise and conduct expert counselling where professionals should refer to correct ways of products declaration.

Key words: craft beer, quality control, declarations, counselling

IMPACT OF PARENTAL BMI ON CHILDRENS' BMI: MODERATING EFFECTS OF GENDER

Taljić I., Memišević H.

University of Sarajevo, Faculty of Educational Sciences, Sarajevo, Bosnia and Herzegovina

Summary

Nutritional status is influenced by many factors. One of the most important factors is parental BMI not only because of genetics but also because of food choices parents make for children. The aim of this study was to analyze relationship between parents' BMI and childrens' BMI. The sample for this study consisted of 280 adolescents, 131 boys (46.8%) and 149 girls (53.2%) living in Canton Sarajevo, Bosnia and Herzegovina. We measured adolescents' BMI and we used parents' self-reported measures to calculate parents' and childrens' BMI. The correlation was significant between mothers' BMI and childrens' BMI (r=.24, p<.01) but not between fathers' BMI and childrens' BMI (r=.08, p=.16). in relation to the child's gender the correlation between mothers' BMI is stronger for the boys (r=.28, p<.01) than for the girls (r=.20, p=.013) and fathers' BMI was correlated with boys' BMI (r=.19, p=.032), but not with girls' BMI (r=.012, p=.88).
Because of the complexity of this issue and the need for precise results, it is recommended to collect more data, with larger sample size and to include additional environmental factors into the prediction model.

Key words: adolescents, parents, BMI, predictor.

DIETARY SURVEY ON ADOLESCENTS, ADULTS AND PREGNANT WOMEN IN BOSNIA AND HERZEGOVINA (B&H MENU) – PILOT STUDY

Arar K[1], Hajrić Dž. [1], Brenjo D. [1], Taljić I.[2], Biber L.[3]

[1]Food Safety Agency of Bosnia and Herzegovina
[2]University of Sarajevo, Faculty of Educational Sciences, Sarajevo, Bosnia and Herzegovina
[3]University of Sarajevo, Faculty of Agriculture and Food Sciences, Sarajevo, Bosnia and Herzegovina

Summary

This paper has the aim at providing an overview of the objective, sample, methodology and procedure of the pilot study of Bosnia-Herzegovinian Dietary Survey of adolescents, adults and pregnant women (B&H Menu). The methodology for conducting the pilot study as well as the main food consumption survey is set by the European Food Safety Authority's (EFSA's) guidelines i 2014.

A random sample stratified by age, gender and place of residence will be drowned from the Master sample 2009. The sampled subjects will be uniformly distributed over four different seasons and the survey calendar will be organised to capture an adequate proportion of weekdays and weekend days at population group level. Detailed food consumption information will be collected by using the 24 hour recall method on two non-consecutive days for each participant. For the main survey, we aim to collect data from minimum 1440 respondents in the following age groups: 10-17 years, 18-64 years and pregnant women.

Key words: B&H Menu, dietary survey, adults, adolescents, pregnant women.

CONTENT AND NUTRITIONAL VALUE OF SELECTED BIOGENIC ELEMENTS IN MONOFLORAL SUNFLOWER BEE-COLLECTED POLLEN FROM SERBIA

Kostić A. Ž.[1], Dojčinović B. P.[2], Nedić N.[3], Milinčić D. D.[1], Pantelić N. Đ.[1], Stanojević S. P. [1], Barać M.[1], Tešić Ž. Lj.[4], Pešić M. B.[1]

[1]University of Belgrade, Faculty of Agriculture, Chair of Chemistry and Biochemistry, Belgrade, Serbia
[2]University of Belgrade, Institute of Chemistry, Technology and Metallurgy, Belgrade, Serbia
[3]University of Belgrade, Faculty of Agriculture, Chair for Breeding and Reproduction of Domestic and Bred Animals, Belgrade, Serbia
[4]University of Belgrade, Faculty of Chemistry, Chair of Analytical Chemistry, Belgrade, Serbia

Summary

Pollen (floral or bee-collected) can be used as a good source of different nutrients including several important biogenic elements (minerals). The aim of this study was to determine content of selected biogenic elements (phosphorous, potassium, sulphur, calcium, magnesium, iron and zinc) in monofloral bee-collected pollen originated from sunflower (*Helianthus annuus L.*) plants grown in Serbia and to estimate its nutritional value regarding to elements content. In that purpose ICP-OES analytical method was applied. According to obtained results the examined pollen sample contains above mentioned elements in following quantities: P - 3523.98 mg/kg; K – 2869.13 mg/kg; S – 1951.74 mg/kg; Ca – 1919.20 mg/kg; Mg – 654.36 mg/kg; Fe – 83.55 mg/kg; Zn – 45.92 mg/kg of dry weight. Based on recommended daily intakes for iron, phosphorous and zinc application of 100 g of pollen, as food or food ingredient, will cover complete (Fe) or significant part (P and Zn) of human needs for these three important elements.

Key words: sunflower, pollen, biogenic elements

THE IMPACT OF THE PRODUCTION METHOD ON THE QUALITY OF MARINATED GARLIC

Akagić A., Bašić A., Đuderija A., Kadić B., Karaman A., Lagumdžija A., Mulagić A., Vražalica A.

University of Sarajevo, Faculty of Agriculture and Food Science, Sarajevo, Bosnia and Herzegovina

Summary

Garlic is highly consumed vegetable in the world and is processed in various forms. Due to easy use and long shelf-life it consumption as ingredient has increased. However, some producers are dealing with intriguing phenomenon that garlic can develop intensive discoloration under certain conditions. Actually during the marinated process garlic change the color into green-blue without negative impact on the consumer's health, but it limits its commercial use and reduces economic value. Therefore, the aim of the paper was to analyze the impact of pre-treatment (mixture of 0.2% citric acid and 0.3% ascorbic acid and blanching 75°C for 3 minutes), type of the blade material (ceramic and stainless steel) and salt and acetic acid concentration (0,8, 1 and 1,5%) on the quality parameters of marinated garlic. Analyzed parameters were the total phenol content (spectrophotometric by Folin-Ciocalteu reagent), texture profile analysis by Texture Analyzer (Stable Micro System, Surrey UK) and sensory characteristics (taste, odor, color and consistency) by 10 panellists. The content of the total phenol and sensory parameters in marinated product was not affected by pre-treatment. However, samples treated in mixture of 0.2% citric acid and 0.3% ascorbic acid had better texture than blanched ones. Higher content of total phenol was recorded in samples produced with ceramic blade in relation to metal. As a result of the importance of phenolic compounds for human health and color and texture for marinated products, it was recommended the production method using ceramic blade with 1.5% acetic acid previously treated with 16% salt concentration.

Key words: sensory evaluation, pretreatment, total phenols, texture profile

THE MONOMERIC ANTHOCYANIN AND TOTAL FLAVONOIDS CONTENT OF THE FRESH, OVEN-DRIED AND LYOPHILIZED GRAPE SKIN AFTER THE VINIFICATION PROCESS

Milinčić D., Popović D., Kostić A., Barać M., Pešić M.

University of Belgrade, Faculty of Agriculture, Chair of Chemistry and Biochemistry

Summary

Wine production results in acquiring a vast quantity of valuable by-products, such as pomace. Pomace and its constituents, skin and seed, have proven to be a valuable source of bioactive compounds that can be extracted and added into a different food product, improving their functional properties. During wine production, polyphenols, important health-promoting compounds, are extracted into wine, but significant amounts remain trapped in the grape skin. Since polyphenols are unstable compounds, there are various procedures for their exploitation from pomace. The aim of this study was to compare the total flavonoid content (TFC) and monomeric anthocyanin content (MAC) of untreated, oven-dried and lyophilized grape skin to determine the effect of applied treatments.

After vinification, the skin of Serbian autochthonous red grape variety „Prokupac“ was treated and extracted with methanol (100%). After that, TFC was determined according to method with $AlCl_3$ and the results were expressed as mg of D+ catechin per g of dry matter (DM). MAC was determined using pH differential method and the results were expressed as mg of malvidin-3-glucoside (M3G) per 100 g of DM. The results of TFC determination were similar for untreated and lyophilised samples, 5.658 and 5.391 mg(D+ catechin)/g DM, respectively, while TFC for dried sample was 4.873 mg(D+ catechin)/g DM. MAC values for untreated, lyophilized and dried sample were 375.707, 310.625 and 245.424 mgM3G/100g DM, respectively.

It can be concluded that applied drying methods reduced TFC and MAC contents of grape skin compared to their content in untreated sample, but by lyophilization the reduction was less pronounced. Further studies are needed to estimate the influence of different drying methods on phenolic compounds in grape by-products.

Key words: grape skin, oven-drying, lyophilization, total flavonoid content, monomeric anthocyanin content.

THE TOTAL PHENOLIC CONTENT OF ALCOHOLIC MEDIUMS ENRICHED WITH INONOTUS OBLIQUUS MUSHROOM

Popović D., Milinčić D., Nikšić M., Nikićević N., Klaus A.

University of Belgrade, Faculty of Agriculture, Institute of Food Technology and Biochemistry

Summary

Inonotus obliquus or Chaga mushroom is a medicinal fungus widely recognized as a source of various bioactive compounds with a remarkable role in disease prevention. Among these compounds, polyphenolic substances have a significant health promoting role. Various authors confirmed their antioxidative, antimicrobial and other beneficial properties, which makes them suitable for food and beverage supplementation.

The objective of this research was to determine total phenolic content (TPC) of alcoholic mediums (plum brandy and refined ethanol) enriched with different concentrations of Chaga (1%, 2,5% and 4%) and extracted during 7, 14 and 21 days, which makes total of 18 samples. TPC was estimated using Folin-Ciocalteu method and the results were expressed as mg of gallic acid equivalents per L (mg/L GAE).

TPC ranged from 68,93 to 355,61 mg/L GAE for refined ethanol and from 91,93 to 314,01 mg/L GAE for plum brandy. The sample with the highest concentration of phenolic compounds was obtained with refined ethanol with 4% of Chaga extracted during 21 days. The second sample with highest concentration was plum brandy with same extraction parameters. It can be seen that TPC rise is strongly correlated with Chaga concentration and extraction duration increase.

The addition of the Chaga mushroom to alcoholic mediums significantly increases their phenolic content, and by this, also its bioactive substance concentration. Extraction in ethanolic solutions also contributes to better yield of phenolics, compared to hot water extraction. Further studies could determine can different concentrations and extraction duration result in enhancement of alcoholic mediums.

Key words: Inonotus obliquus, Chaga, alcoholic mediums, total phenolic content, extraction.

ANALYSIS OF GLYCEMIC INDEX LOAD OF RASPBERRY JAM

Veladžić M.[1], Šertović E.[1], Veladžić N.[2], Smajić S.[1], Beganović E.[3]

[1]University of Bihać, Biotechnical Faculty, Bihać, Bosnia and Herzegovina
[2]Emergency medicine care of Sarajevo, Sarajevo, Bosnia and Herzegovina
[3]Pharmacy Edita Bihać, Bihać, Bosnia and Herzegovina

Summary

This study included five healthy female and five healthy male students who study Islamic faculty of Pedagogy in Bihać. Experiments took place in April 2019, and lasted for three weeks. We tested blood glucose level to all participants before starting experiments in all three cases by Glucocard S Blood Glucose Metar. We used 25g of glucose as reference sample, and raspberry jam which was produced by standard procedure, with mass of 37,1g and free amount of sugar of 25g, as a control sample. Raspberry jam with 6% of inulin added, with mass of 40,3g and 25g of free sugar was used as test sample. Participants drank 250ml of water after consuming each sample in all experiments. Capillary blood glucose was measured at 15, 30, 45, 60, 90, and 120 min after starting to eat.

Key words: glycemic index, students, blood glucose, raspberry jam, inulin

FERMENTATION OF COW'S MILK AND SOY MILK MIXTURE WITH L. ACIDOPHILUS PROBIOTIC BACTERIA WITH YOGHURT CULTURE

Šertović E.[1], Sarić Z.[2], Božanić R.[3], Barać M.[4], Barukčić I.[3], Kostić A.[4]

[1]University of Bihać, Biotechnical Faculty
[2]University of Sarajevo, Faculty of Agriculture and Food Sciences, Sarajevo, Bosnia and Herzegovina
[3]University of Zagreb, Faculty of Food Technology and Biotechnology, Department of Food Engineering, Zagreb, Croatia
[4]University of Belgrade, Faculty of Agriculture, Chair of Chemistry and Biochemistry, Belgrade, Serbia

Summary

The aim of the paper was to produce a functional product and to determine the physicochemical, microbiological and sensory properties of probiotic beverages produced from different ratios of cow's milk and soy milk. The ratios of cow's milk and soy milk were 100: 0%, 25: 75%, 50: 50%, 75: 25% and 0:100%. The samples were fermented with probiotic bacteria *Lactobacillus acidophilus* (La5) with the addition of yogurt culture. The fermentation of samples was performed at + 43 °C until coagulation and pH value of 4.6. Characteristics of the obtained beverages were monitored during storage at 1st, 7th, 14th and 21st day of storage at +4° C. Produced probiotic beverages were observed and change in active acidity, titration acidity, change in the number of probiotic bacteria, and sensory properties and acceptability of products were tracked. After fermentation, the number of lactobacilli in the samples produced gradually decreased during 21 days, but was still above the probiotic minimum (CFU 106 mL^{-1}) so the samples had probiotic properties. Samples of fermented beverages got the best score of their sensory properties on the seventh day of preservation. The sensory properties of the samples were mainly influenced by the type and ratio of the used milk. Mixing cow's milk with soy milk significantly improved the sensory properties of the product. The acceptance test showed good acceptance of fermented beverages samples by potential consumers, apart from the sample that was 100% soy beverage.

Keywords: cow's milk, soy beverage, probiotics, Lactobacillus acidophilus

DETERMINATION OF ANTIOXIDANT AND HEAVY METALS IN COLD-PRESSED EDIBLE OILS

Nezirević-Nizić E.[1], Čorbo S.[2], Podrug S.[3], Begić M.[2]

[1]Federal Institute Of Agropedology, Sarajevo, Bosnia and Herzegovina
[2]University of Sarajevo, Faculty of Agriculture and Food Sciences, Sarajevo, Bosnia and Herzegovina
[3]Argeta doo Sarajevo, Sarajevo, Bosnia and Herzegovina

Summary

The aim of this research was to determine the antioxidant and heavy metals content in various types of cold-pressed oil produced in Bosnia and Herzegovina. Samples of cold-pressed pumpkin, sunflower and linseed oils were collected during two seasons and analyzed.

During the first season, cold-pressed pumpkin oil had a significantly higher content of total phenols, chlorophylls and carotenoids. Cold-pressed linseed oil, during the first season, had a significantly higher content of chlorophylls and carotenoids in comparison with the same oil in the second season. Cold-pressed sunflower oil from the first season had a significantly higher content of total phenols and chlorophylls in comparison with the sunflower oil from the second season.

In the first season, cold-pressed sunflower oil compared to other oils had a significantly higher content of Pb, Cu and Cd. In the second season, cold-pressed pumpkin and linseed oil contained a significantly higher amount of Cu compared to cold-pressed sunflower oil. The content of Cd is significantly higher in cold-pressed linseed and sunflower oil compared with cold-pressed pumpkin oil. In the second season cold-pressed linseed oil had significantly higher amount of heavy metals compared to linseed oil from the first season.

Key words: cold-pressed oils, total phenolic compound, chlorophylls, carotenoids, heavy metals

DETERMINATION OF AFLATOXIN M1 IN RAW MILK BY THE ELISA METHOD IN THE UNA-SANA CANTON

Jukić H.[1], Dedić S.[2], Rodić M.[3], Jusufhodžić Z.[3], Demirović D.[3]

[1]University of Bihać, Faculty of Health Studies, Bihać, Bosnia and Herzegovina
[2]University of Bihać, Faculty of Biotechnology, Bihać, Bosnia and Herzegovina
[3]Public institution "Veterinary Institute" Bihać, Bihać, Bosnia and Herzegovina

Summary

The presence of aflatoxin M1 (AFM1) in raw milk should be continuously monitored to protect the population from the risks associated with proven toxicity and carcinogenicity. The ELISA method offers many advantages, including shorter time of analysis, simultaneous analysis of a large number of samples, acceptable as a screening method, limited use of organic solvents, absence of complicated sample preparation steps and simplicity of analytical procedure compared to long-lasting and expensive chromatographic techniques. The test is highly sensitive with a detection limit of 0.01 µg / kg and a quantitative range of 0.01 -0.1 µg / kg. In the Una-Sana Canton in 2018, 27 samples of raw cow milk were analysed and all the analyses were carried out twice. The highest concentration of AFM1 was in December and it was 0.032 µg / kg, which is a permissible concentration of AFM1 according to the Regulations on Maximum levels for certain contaminants in food, Official Gazette No. 37/09, which is in compliance with European Union regulations (EU) and the Codex Alimentarius Commission (CAC). In a case of a positive result, the samples are analysed several times and sent to a certified chemical laboratory for the super analysis for the confirmation of the results.

Key words: aflatoxin M1, raw milk, ELISA

QUANTIFICATION OF TOXIC AND POTENTIALLY TOXIC ELEMENTS IN VEGETABLES BY MEANS OF ICP-OES AND HEALTH RISK ASSESSMENT

Irena Miljković I[1], Popović-Đorđević J.[1], Rajković M. B.[1], Kostić A. Ž.[1], Popović B.[2], Brčeski I.[3]

[1]University of Belgrade, Faculty of Agriculture, Chair of Chemistry and Biochemistry, Belgrade, Serbia
[2]University of Belgrade, Faculty of Agriculture, Chair of Agribusiness Management, Belgrade, Serbia
[3]University of Belgrade, Faculty of Chemistry, Beograd, Serbia

Summary

Vegetables play an important role in human nutrition and their importance in diet is determined by its chemical composition. Numerous studies indicate a high degree of contamination of soil and plants produced in certain agro-ecological conditions, especially near urban and industrial areas. Accordingly, toxic and potentially toxic elements (aluminum, chromium, copper, manganese, nickel, lead and zinc) were quantified in edible parts of four vegetable species (potato, cabbage, carrot and broccoli) by means of inductively coupled plasma–optical emission spectrometry (ICP–OES). In addition, health risk assessment was done and expressed through estimated weekly intake of elements (EWI) and hazard quotient (HQ). Samples of each species originating from different localities were collected from three green markets in the city of Belgrade (Serbia). The content of studied elements ranged from 1.32 to 4.00, 0.31 to 5.77, 3.50 to 23.11, 1.82 to 11.17 and 2.11 to 10.62 mg/kg for aluminum, cooper, manganese, nickel and zinc, respectively. Chromium was detected in carrot sample (1.76 mg/kg), whereas concentration of lead in two samples of broccoli exceeded the maximum allowed concentration (>0.1) set by the national regulations. The average estimated weekly intakes for Al, Cu, and Zn were within the safe limits set by FAO/WHO, while for Ni and Pb in some vegetables were considerably higher than proposed values. In respect to the obtained results, a great weekly health risk was indicated for chromium, nickel and lead with the highest HQ values: 2.44, 10.32 and 2.02, respectively. The results of the study impose the necessity for continuous monitoring of harmful elements content in individual vegetable crops as well as strict regulative guidelines in order to diminish pos-sibility of contamination.

Keywords: vegetables, toxic elements, ICP–OES, estimated weekly intake, health risk

DEVELOPMENT AND IN-HOUSE VALIDATION OF HACH SPECTROPHOTOMETRY METHOD FOR DETERMINATION OF PHOSPHORIC ACID IN COLA BEVERAGES

Jesenković-Habul L., Čustović A., Dizdarević S.

Institute for Public Health of the Federation of Bosnia and Herzegovina

Summary

A cheap and a rapid HACH spectrophotometric method 8048 was developed and validated for the quantitative estimation of phosphoric acid in soft drinks. The developed method resulted in phosphoric acid exhibiting linearity in the range from 0.02 to 2.5 mg/L. The precision is exemplified by relative standard deviation of 3.45%. Percentage Mean recovery was found to be in the range of 90-107%, during accuracy studies. The limit of detection (LOD) and limit of quantitation (LOQ) were found to be 0.0075 mg/L and 0.02 mg/L respectively. Accordingly, it is concluded that the developed HACH spectrophotometric method 8048 is accurate, precise, linear and rugged, and therefore the method can be used for the routine analysis of phosphoric acid in soft drinks.

Keywords: soft drinks, phosphoric acid, HACH method

PHENOL CONTENT AND ANTIOXIDANT ACTIVITY OF DIFFERENT BLUEBERRY SPECIES FROM PROZOR REGION

Kazazic M., Aliman J., Djogic S., Djapo-Lavic M.

Dzemal Bijedic University of Mostar, Mostar, Bosnia and Herzegovina

Summary

Blueberries are considered as functional foods due to their high content of bioactive compounds. This study was undertaken to investigate total phenol content, total anthocyanins and antioxidant activities of wild bilberry and two highbush blueberry cultivars Bluecrop and Goldtraube from Bosnia and Hercegovina. Extracts were investigated for their antioxidant properties using ABTS radical scavenging capacity assay and ferric reducing antioxidant potential (FRAP) assay. Total phenolic content was determined by spectrophotometric method using Folin-Ciocalteu reagent. Results indicated highest phenolic content (280,55±7,22 mg GA/100 g FW) in wild bilberry. Wild bilberry showed the highest antioxidant activity regardless of the method used. Content of total anthocyanins detect-ed in wild bilberries (178,7±0,46 mg cyaniding-3-glycoside)/100 g FW) was higher than in highbush blueberry cultivars investigated. Significant relationship between antioxidant activity and total phenolic content indicates that the phenolic compounds are the major contributors to the antioxidant properties of these fruits.

Keywords: total phenols, antioxidant activity, anthocyanins

BIOLOGICAL ACTIVITY AND NUTRITIONAL POTENTIAL OF *RUMEX CRISPUS L.* AND *RUMEX OBTUSIFOLIUS* L.

Bektašević M., Oraščanin M., Šertović E.

University of Bihać, Biotechnical faculty, Bihać, Bosnia and Herzegovina

Summary

The wild growing plant species *Rumex crispus L.* and *Rumex obtusifolius L.* (Polygonaceae) are used in human nutrition and in traditional medicine of many countries. Both plant species are a significant source of antioxidants and antibacterial compounds. Some studies indicated that the consumption of both plant species may be useful due to high content of proteins, antioxidants and other nutritionally valuable compounds. This paper gives an overview of the use of *Rumex crispus L.* and *Rumex obtusifolius L.* in traditional medicine, as well as a review of current research for these plant species in terms of their nutritional value, antioxidant and antimicrobial activity.

Key words: Rumex crispus L., Rumex obtusifolius L., traditional medicine, biological activity

ANALYSIS OF THE FAT SUBSTITUTION IN BISCUIT TYPE CAKES BY THE ADDITION OF INULIN

Veladžić M., Jahić S. , Džaferović A.

University of Bihać, Biotechnical faculty, Bihać, Bosnia and Herzegovina

Summary

Cakes are the products with a high content of sugar and fat, and one of the methods of improving their nutritional profile is the addition of the functional products in the recipe for making cakes, such as inulin. Addition of inulin, it can be of fat reduction in the final product, without a significant changes in the water content and sensory properties. This study aimed at developing formulations of cakes with partial replacement of fat by inulin as well as evaluating physical, chemical and sensory characteristics. In the recipe for the cakes has added 2%, 4% and 6% of inulin with the reduction in fat content. Biscuits with inulin content of 2% had reduction of the total fat 44.6%, while in the cakes with 4% of inulin, the reduction of the fat content was 64.8%, and the cakes with 6% of inulin had the reduction of the fat 75.8 %. In the samples with 2% and 6% of inulin, the percent of the moisture was higher with regard to a standard, but, in the samples with 2% of inulin, the percent of the moisture was lower ($p<0.01$) regard to a standard. Once content of inulin was increased, the size of the cakes after baking also increased; all samples had a higher thickness regard to a standard, and the diameter of the cakes was higher regard to a standard in the all samples, but it wasn't higher in the samples with 2% of inulin. According to the results of the sensory analysis, the Commission classified the samples with 2% and 6% of inulin into the category very good and the samples with 4% of inulin in the category good. According to the consumer's estimation, the best were estimated the cakes with 6 % of inulin.

Key words: fat substitution, cakes, inulin

FATTY ACID COMPOSITION AND STABILITY OF COLD-PRESSED VEGETABLE OILS

Begić M.[1], Nezirević-Nizić E.[2], Čorbo S.[1], Podrug S.[3], Ašimović Z.[1], Muminović Š.[1]

[1]University of Sarajevo, Faculty of Agriculture and Food Science, Sarajevo, Bosnia and Herzegovina
[2]Federal Institute of Agropedology, Sarajevo, Bosnia and Herzegovina
[3]Argeta d.o.o. Sarajevo, Sarajevo, Bosnia and Herzegovina

Summary

The aim of this study was to determine the composition of fatty acids and stability of different cold-pressed vegetable oils manufactured in Bosnia and Herzegovina. Three kinds of cold-pressed oils were used during the experiment (pumpkin oil, linseed oil and sunflower oil). The composition of fatty acids (both saturated and unsaturated), peroxide value, and content of free fatty acids has been determined on tested samples. The largest amount of saturated fatty acids during the two-year research was found in pumpkin oil with the largest share of palmitic acid. The content of unsaturated fatty acids in all the tested samples was larger in the first year of research. The highest content of unsaturated fatty acids in two years of research was found in linseed oil with largest share of α-linolenic acid. The highest peroxide value and content of free fatty acids were found in linseed oil. Both parameters that were tested had lower values in the second year of testing in all the samples.

Keywords: cold-pressed oils, peroxide value, fatty acid composition, free fatty acid contents

ASSESSMENT OF BOILING WATER IN THE OPEN SYSTEM IN THE PROCESS OF WATER PURIFICATION

Jamaković N.

University of Sarajevo, Faculty of Agriculture and Food Science, Sarajevo, Bosnia and Herzegovina

Summary

The water purification process removing unwanted chemicals, biological contaminants, suspended solids and gases from the contaminated water with a specific purpose (drinking water, water for pharmaceutical, medical, technological and industrial applications). Boiling water is often used in housework and in the food industry. The aim of this paper is to check the efficiency of boiling water in the open system in the process of water purification, and assess whether it can really purify drinking water until adequate measures. The study used four types of samples of water: tap water, water from the market, water from polluted river and independently made modal system. The results showed that boiling water in the open system reduces magnesium, iron and lead concentrations, and increases chloride, copper (or it only doesn't remove it, or it may even decrease) and cadmium concentrations. The concentration of potassium, calcium and sodium depends on the starting sample, and magnesium is disproportionate to calcium. We can say that boiling water in the open system doesn't remove chloride and cadmium, it removes carbonates well and it is not a good copper purifier (but that conclusion is not safe and ultimate).

Keywords: water, purification, boiling, metals, chlorides

INFLUENCE OF ALCOHOL CONTENT IN INTIAL DISTILLATE ON DISTRIBUTION OF METHANOL AND HIGHER ALCOHOLS DURING REDESTILATIONS

Jamaković N., Spaho N.

University of Sarajevo, Faculty of Agriculture and Food Sciences, Sarajevo, Bosnia and Herzegovina

Summary

Quality of strong alcoholic beverage depend on quantity and quality of volatile compounds that can exhibit both positive and negative effects. Esters and higher alcohols are among the most important positive compounds in the brandy while the methanol is the most abundant harmful compound compounds in spirits. In order to improve the sensory quality of the products, but also to improve the quality from a toxicological point of view, the aim is to minimize the effect of less desirable components, and highlight the effect of more desirable components. When some compound will distil, it depends on its boiling point, but also its solubility in alcohol or water as the main carriers of all volatile compounds. Therefore, the content of alcohol in initial mixture is very important for distribution of other volatile compounds during distillation. The aim of this paper is to examine how the amount of alcohol in initial distillate influence on evaporation dynamics of methanol and higher alcohol during redistillations. The evaporation dynamics will be calculated by separating the fractions during the redistillation of two initial distillates with 20% vol. and 60% vol. of alcohol. Content of methanol and higher alcohol was determinate by spectrophotometric method. The results showed that in the low-alcoholic mixtures significantly higher of higher alcohols are separated in the first fraction (head), and the methanol in the last fraction (tail), while the opposite dynamics of those compounds were evident in redistillation of high-alcoholic mixtures.

Key words: distillation, methanol, higher alcohols

COMPOSITION OF SUNFLOWER SEEDS OF CONFECTIONERY NS HYBRIDS GROWN IN SMALL PLOT TRIALS IN SERBIA

Romanić R.[1], Lužaić T.[1], Grahovac N.[2], Hladni N.[2], Kravić S.[1], Stojanović Z.[1]

[1]University of Novi Sad, Faculty of Technology Novi Sad, Serbia
[2]Institute of Field and Vegetable Crops Novi Sad, Serbia

Summary

Hybridization of sunflower is more often going in direction of increasing the protein content in seeds. Sunflower proteins have favorable amino acid composition and low content of antinutritive compounds in seeds. This leaded to increased number of confectionery/non-oily sunflower hybrids. The aim of this paper was to investigate the composition of the three seeds of the latest NS hybrids of second filial (F2) generation (NS-H-6791, NS-H-6488, NS-H-6304) grown in Serbia in 2017. The content of moisture was determined according to EN ISO 665, the content of the oil according to EN ISO 659, while the mass of 1000 seeds and the content of hull and kernels were made according to Karlović and Andrić, 1996. The moisture content ranged from 5.66±0.05% found in the sample NS-H-6791 to 6.03±0.02%, in the sample NS-H-6304. The oil content was in the range of 21.98±0.11%, found in the sample NS-H-6304 to 25.20±1.05%, found in the sample NS-H-6488. The mass of 1000 seeds determined on dry matter amounted to a maximum of 139.63±5.62 g in the sample NS-H-6488, while the smallest value was 120.95±3.29 g in the sample NS-H-6304. The highest content of the hull was found in the NS-H-6791 sample, 45.10±1.80%, while the smallest content of the hull was found in the sample NS-H-6488 and amounted to 36.98± 0.28%.

Key words: Sunflower seeds, non-oily hybrids, oil content, mass of 1000 seeds, hull content.

CHANGES OF QUALITY PARAMETERS DURING FRYING OF ĆEVAPI PRODUCED WITH DIFFERENT PRODUCTION TECHNOLOGIES

Operta S., Alijagić B.

University of Sarajevo, Faculty of Agriculture and Food Sciences, Sarajevo, Bosnia and Herzegovina

Summary

The aim of this paper was to examine changes in quality parameters of ćevapi produced with two different production technologies during frying. Variant A was produced from a combination of chilled meat of category II and III, and variant B from a combination of fresh and frozen beef meat of category I and II with the addition of bovine tallow. Pepper and spice supplement “Vegeta" were added in both variants. Additionally, acidity regulator was added in variant A, and crumbs and ajvar in variant B. The test results showed that during frying there was a significant decrease ($p<0.05$) in content of water and fat content, weight loss and ćevapi length, and a decrease of b* value (yellowness) in both variants of ćevapi. The average protein, ash, and NaCl content increased significantly ($p<0.05$) in both ćevapi variants during frying. Values L* (light) as well as the diameter of the ćevapi did not change significantly ($p>0.05$) during heat treatment. Loss during frying in variant B (35.95%) was greater than in variant A (20.94%). Lower retention rate of water (61.41%) and fat (55.30%) were found in variant B in relation to variant A (75.03%, 73.01%). Exterior appearance, color and overall impression were significant ($p <0.05$) better rated in variant A than in variant B. The overall impression showed that variant A is “moderately liked" and variant B "little liked" by the evaluators.

Keywords: Ćevapi, production technology, physico-chemical parameters, sensory quality

CHEMICAL COMPOSITION AND TECHNOLOGICAL PROPERTIES OF CHICKEN MEAT OF DIFFERENT COMMERCIAL BRANDS AVAILABLE IN SALE FACILITIES IN SARAJEVO

Operta S., Omerović E.

University of Sarajevo, Faculty of Agriculture and Food Sciences, Sarajevo, Bosnia and Herzegovina

Summary

The aim of this study was to compare the chemical composition and technological properties of chicken meat without skin (breast and legs) of five different commercial brands (I, II, III, IV, V) available in sales facilities in Sarajevo. The results of the study showed that there was a significant difference ($p<0.05$) in the content of mineral substances, pH values, color values (L *; a *; b *), and loss indicators by dropping and cooking chicken breasts between commercial brands. Significant differences ($p<0.05$) between commercial brands were expressed for all examined parameters of chicken leg meat, except for water content and redness values (a *). Chicken breast meat of all commercial brands contained of: 71.4% water, 22.5% protein, 1.5% fat, 1.1% mineral substances and 25% dry matter. Chicken leg meat of all commercial brands, on average, contained: 73.2% water, 19.4% protein, 3.9% fat, 1.1% mineral substances and 24.2% dry matter. The pH of chicken breast meat was 5.9, and chicken leg meat 6.3, on average for all commercial brands. The thigh meat, on average for all commercial brands, showed a higher loss of drip (5.9%) compared to breast meat (3.8%), as well as greater loss of cooking (28.6%) compared to breast meat (23.9%) and drumstick meat (25.2%). The L * value of the color had a significant negative correlation with respect to a * value of color in both breast and leg meat. There were also strong positive correlations between the pH value and the b * value of the color in the chicken breast.

Key words: commercial brands, chicken meat, chemical composition, technological properties

EVALUATION OF MICROBIOLOGICAL PARAMETERS OF DRINKING WATER FROM THE DOBRENICA WATER SUPPLY SYSTEM IN OSTROŽAC NA UNI

Dedić S.[1], Jukić H.[2], Džaferović A.[1], Rodić M.[3], Jusufhodžić Z.[3]

[1]University of Bihać, Faculty of Biotechnology, Bihać, Bosnia and Herzegovina
[2]University of Bihać, Faculty of Health Studies, Bihać, Bosnia and Herzegovina,
[3]Public institution "Veterinary Institute" Bihać, Bihać, Bosnia and Herzegovina

Summary

The Dobrenica water supply system in Ostrožac na Uni was originally intended only for drinking water supply for the Sedra Hotel. Later on, the left and the right side of the village Ostrožac na Uni, i.e. Donji Srbljani, were connected to the Dobrenica water supply. Since the Sedra Hotel has been closed for three years, the maintenance of the water supply system and the chlorination of water has ceased. At the moment, the water is chlorinated at the entrance to the hotel facility due to special circumstances (holding facilities for migrants), while the villagers still receive unsafe and nonchlorinated water. Water samples were analysed for basic microbiological parameters: *Echcerichia coli* and *coliform bacteria*, total aerobic colony count at 22°C and 37°C, *intestinal enterococci*, *Pseudomonas aeruginosa* and *Clostridium perfringens*. Microbiological analyses of water samples were performed in the laboratory of the Public Institution Veterinary Institute in Bihać, which has accredited methods required by the Standard BAS EN ISO / IEC 17025: 2006 issued by the Institute for Accreditation of BiH, and MACs are taken from the Guidelines for drinking-water quality ("Official Gazette of BiH", No. 40/2010, 43/2010, 30/2012 and 62/2017). The results of the analyses indicate the presence of coliform bacteria, *Echcerichia coli*, *Pseudomonas aeruginosa*, *Clostridium perfringens* and *intestinal enterococci*. A high percentage of unsafe water samples indicate the need to monitor the microbiological quality of water for safer drinking water supply to the population.

Key words: water, microbiological parameters, chlorination

THE CONTENT OF POLYPHENOLS IN THE SAMPLES OF DARK CHOCOLATE ON THE SERBIAN MARKET

Jaćimović S., Kostić A. Ž., Pantelić N.

University of Belgrade, Faculty of Agriculture, Department of Chemistry and Biochemistry

Summary

Cocoa and cocoa-based products, such as dark chocolate, are widely widespread and very used both as a sweet and as a good source of polyphenols. Due to presence a significant amount of bioactive components, such as polyphenols and flavanoids, it is considered that dark chocolate exhibits antioxidant activity. In this work, different kinds of dark chocolates from the Serbian market were analyzed regarding to polyphenols content.

Considering that a large number of researches are based on the potential positive influence of dark chocolate on human health the aim of this study was to examine the amount of free (extractable) polyphenols depending on the quantity of cocoa in samples of dark chocolate. Briefly, after defatting with petrol ether, ten samples were extracted with solvent containing acetone-water-acetic acid (80 : 19.5 : 0.5, v/v/v). In order to increase yield of bioactive compounds extraction procedure was repeated twice. The content of polyphenols was determined according to Folin-Ciocalteu method. The results were expressed as mg of galic acid equivalents (GAE) per gram of dry weight (dw) of samples.

The results have shown that the content of polyphenols was ranged between 10.52 and 36.09 mg/g dw GAE. The obtained results demonstrate that the sample with the highest percentage of cocoa exhibits the highest content of polyphenols. In addition, the samples of dark chocolate with dried orange or raspberry pieces contain a higher amount of free polyphenols than chocolate without the addition of fruits with the same cocoa content.

It can be concluded, by observing the obtained results, that there are differences in the amount of free polyphenols in different chocolate samples, depending on the amount of cocoa in dark chocolate and addition of dried fruit pieces.

Key words: Dark chocolate, Cocoa, Polyphenols

DYNAMICS OF MICROBIAL POPULATIONS ACTIVITIES AFTER THE APPLICATION OF NICOSULFURON

Saud Hamidović S., Lalević B., Borovac B., Kazlagić A., Haseljić S., Raičević V., Đikić M.

University of Sarajevo, Faculty of Agriculture and Food Science, Sarajevo, Bosnia and Herzegovina

Summary

When a pesticide gets into soil, it takes part in a number of physical, chemical and biological processes that depend not only on the compound itself, but a number of other factors such as: physical, chemical and biological characteristics of soil and climatic factors. Microorganisms play an important role in pesticide degradation as they are able to utilize the biogenic elements from those compounds, as well as energy for their physiological processes. On the other hand, pesticides are more or less toxic substances that can have adverse effect on microbial populations and prevent their development, reduce their abundance, deplete their taxonomic complexity and create communities with a lower level of diversity and reduced physiological activity. The aim of this study was to analyze post nicosulfuron application activities dynamics of microbial populations in the soil. Standard methodology was used for the determination of chemical parameters (pH, humus content, available P and K), while microbial abundance (total number of bacteria, number of ammonia, fungi and actinomycetes) was determined by agar plate method. At each subsequent sampling, the stimulating effect grew. The application of nicosulfuron in all samples and at both locations has resulted in increased number of bacteria, fungi and ammonifier and reduction of the number of actinomycetes. The highest positive effect on the number of microorganisms was 15 days after treatment with nicosulfuron.

Keywords: Soil, Pesticides, Microorganisms, Nicosulfuron

METAL CONTENT IN HONEY WITH DIFFERENT COLORING FROM INDUSTRIAL AREAS OF BOSNIA AND HERZEGOVINA

Jurković J., Ploskić M., Murtić S., Gavrić T., Biber L., Omanović Mikličanin E., Kazlagić A.

University of Sarajevo, Faculty of Agriculture and Food Science, Bosnia and Herzegovina

Summary

Honey is the food which is used by humans since ancient times and is highly valued due to its nutritional value. Most metals which are found in soil - plants system can be found in honey also. The aim of this research is to see could some metals from industrial areas of Bosnia and Herzegovina be found in honey samples and to see is there a difference in amount of metals in dark and light versions of honey. In honey samples some basic quality parameters were measured: water activity, pH, electrical conductivity, moisture content, dry matter content. Also, concentrations of five metals were determined: K, Na, Ca, Mg and Fe. Concentration of metals were determined by means of FAAS (Flame Atomic Absorption Spectrophotometry) and FP (flame photometry). For statistical evaluation, descriptive statistics was used, one – way ANOVA, and correlation. The results are showing differences between honeys from different industrial areas, and among honeys of different coloring. High correlations (above 0.900) were found between concentrations of K and pH (0.962) and between K and EC (0.975).

Keywords: Honey, metals, industry, color, correlation

INNOVATIVE TECHNOLOGIES IN AGRICULTURE AND FOOD INDUSTRY

EFFECTS OF STABILIZING AGENT ON THE GREEN SYNTHESIZED SILVER NANOPARTICLES AND ITS ANTIMICROBIAL ACTIVITY STUDIES

Kazlagić A.[1], Mršo E.[1], Ali Abud O.[2], Borovac B.[1], Hamidović S.[1], Omanović-Mikličanin E.[1]

[1]Faculty of Agriculture and Food Sciences, University of Sarajevo, Sarajevo, Bosnia and Herzegovina
[2]Department of Radiology, Clinical Center University of Sarajevo, Sarajevo, Bosnia and Herzegovina

Summary

In this study, a new green method of preparing silver nanoparticles (AgNPs) using fresh leaf extract of different types of onion has been proposed. The effects of stabilizing agent on the green synthesized AgNPs has been investigated, as well as the antimicrobial activity using Disk diffusion method. AgNPs demonstrated antimicrobial activity against Salmonella spp.

Keywords: Green synthesis, stable silver nanoparticles, spectrophotometry, antimicrobial activity

GREEN SYNTHESIS AND CHARACTERIZATION OF SILVER NANOPARTICLES USING FRESH LEAF EXTRACT OF ALOE VERA BARBADENSIS MILLER, ALOE VERA AND SEMPERVIVUM TECTORUM AND ITS ANTIMICROBIAL ACTIVITY STUDIES

Kazlagić A.[1], Lagumdžija A.[1], Borovac B.[1], Hamidović S.[1], Ali Abud O.[2], Omanović-Mikličanin E.[1]

[1]Faculty of Agriculture and Food Sciences, University of Sarajevo, Sarajevo, Bosnia and Herzegovina
[2]Department of Radiology, Clinical Center University of Sarajevo, Sarajevo, Bosnia and Herzegovina

Summary

New technology's advances have inspired the development and application of new products in food industry, which brings to new challenges featuring food safety. Demands from consumers for more natural foodstuff are increasing, which puts aside conventional methods for controlling the microbial growth, such as thermal processing or adding chemical preservatives. New methods are being highlighted, due to features such as controlling microbial growth without damaging the product. Nowadays, nanotechnology is considered as promising technology for the food industry in general, as well as for new methodologies in the entire agri-food chain. The use of plant extract for the synthesis of metal nanoparticles represents a great, harmless, environmental friendly and promising alternative to traditional chemical methods. In this study, a new green method of preparing silver nanoparticles (AgNPs) using fresh leaf extract of *Aloe vera barbadensis Miller*, *Aloe vera* and *Sempervivum tectorum* has been proposed. Antimicrobial activity study was assessed using Disk diffusion method. AgNPs demonstrated antimicrobial activity against *Salmonella spp.* but showed no effect on *Escherichia coli*. This study indicates that AgNPs synthesized this way could be a new potential candidate for use in agricultural, biological, and pharmaceutical applications for fighting infections caused by microorganisms.

Keywords: Green synthesis, silver nanoparticles, spectrophotometry, antimicrobial activity, Aloe vera, Sempervivum tectorum

APPLICATION AND IMPACT OF NANOTECHNOLOGY IN SPORT

Ćibo M., Šator A., Kazlagić A., Omanović-Mikličanin E.

University of Sarajevo, Faculty of Agriculture and Food Science, Sarajevo, Bosnia and Herzegovina

Summary

Nanotechnology has been widely used in the last decade. Today, nanotechnology brings many benefits in our daily lives. The term "nano" in theory appeared much earlier in the same application in various areas, due to not having adequate equipment nor technology that could explore such "small" particles. In addition to all possible applications, nanotechnology, has one of the most important application and that is sports. Improvement of sports equipment by nanoparticles in many sports it brought to a clear development in the performance of athletes, achieving better results and quality of new equipment. In this review, we are approaching nanotechnologies and sports, the possibility of applying nanomaterials such as carbon nanotubes, fullerenes, carbon nanoparticles, silicon dioxide nanoparticles and others to create sports equipment in various sports such as cycling, golf, tennis, skiing, surfing. The impact of nanotechnology, as a new technology in sports has been briefly explained.

Nanotechnology, Application, Nanoparticles, Nanomaterial, Sport

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