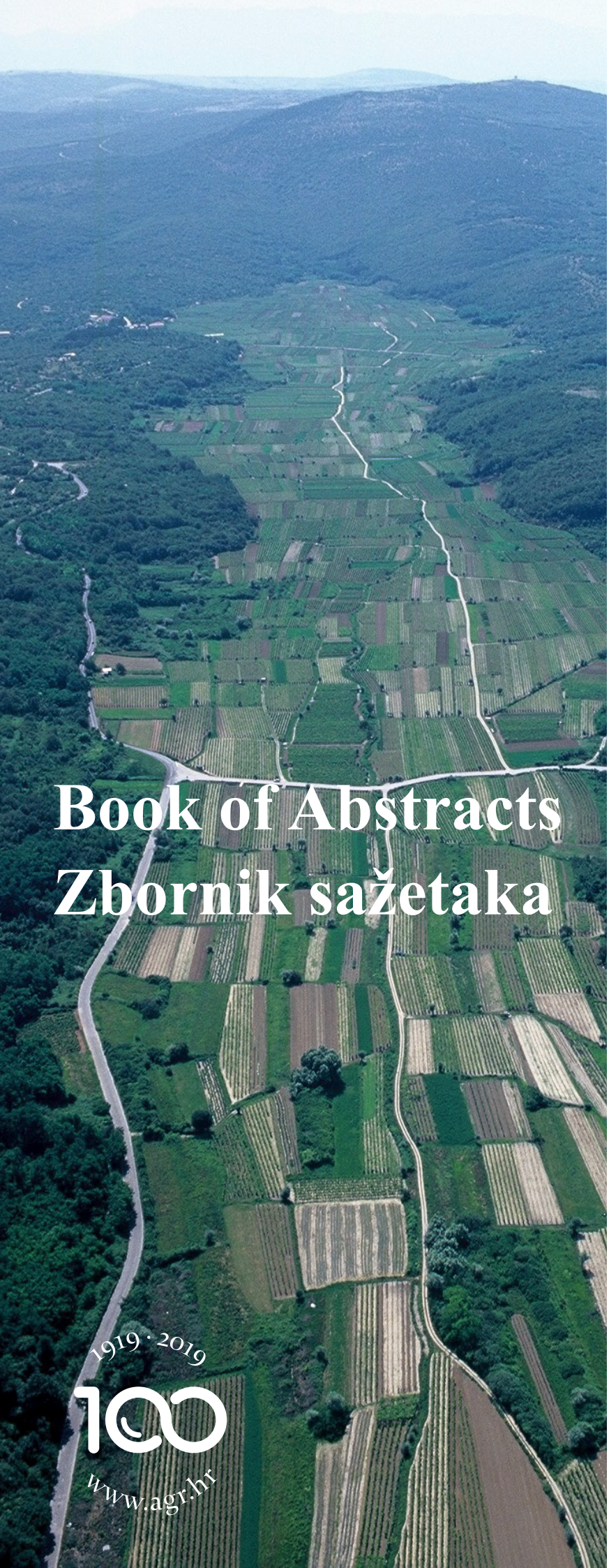

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Hrvatska poljoprivreda i održiva bioekonomija

Zoran GRGIĆ

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Sažetak

Tradicionalna bioekonomija nije nova – poznata nam je kao poljoprivreda i šumarstvo ili poljoprivredno-prehrambeni sustav. Trenutačni poljoprivredno-prehrambeni sustav nije održiv, jer proizvodi otprilike 20-25% emisija stakleničkih plinova koje uzrokuju klimatske promjene; uzrokovao je degradaciju tala u dijelu obrađenog zemljišta; troši oko 70 % vode koju ukupno koristimo, pretjeruje s korištenjem mineralnih gnojiva i pesticida koji uzrokuju velika onečišćenje rijeka, jezera i obalnih područja te je odgovoran za krčenje šuma, gubitak močvarnih područja i biološke raznolikosti. Poljoprivreda budućnosti, kad već nije i sadašnjosti je ona koja mora zadovoljavati potrebe postojećih i budućih generacija osiguravajući istovremeno profitabilnost, zaštitu okoliša te socijalnu i ekonomsku jednakost. U RH nije ni održiva poljoprivreda iz 70-ih godina prošlog stoljeća uvedena kao efikasni sustav, što pokazuju podaci o slabom korištenju resursa, smanjenju proizvodnje i tržnih proizvođača, ali i uvozu hrane te padu udjela poljoprivrede u BDP - u. Zato će nam biti teže odrediti mjesto poljoprivrede u bioekonomiji i bioekonomije u poljoprivredi i ruralnom razvoju. Održiva bioekonomija označava proizvodnju iz obnovljivih bioloških resursa (iz tla i mora) te pretvorbu proizvoda i otpadnog materijala u hranu, bioproizvode i bioenergiju. Ona obuhvaća poljoprivredu, šumarstvo, ribarstvo, proizvodnju hrane i papira, dijelove kemijske i biotehnološke industrije te proizvodnje energije. Veća primjena obnovljivih izvora više nije samo jedna od opcija, već je nužnost. Europa se pritom mora transformirati iz društva razvijenog na fosilnim sirovinama u društvo na biotemeljima, a pogonska sila tog procesa su istraživanje i inovacije, što daje dobru priliku akademskoj zajednici, pogotovo nama iz biotehničkog područja. Proces prelaska ekonomije na bioekonomiju važan je kako za okoliš, tako i za sigurnost hrane i energije, ali i za cjelokupnu konkurentnost E urope u budućnosti.

Potrebna je provedba multidisciplinarnih programa obrazovanja u cijeloj EU, što bi trebalo rezultirati povećanjem mogućnosti i za visoko i za nisko kvalificiranu radnu snagu. U cijelom procesu važna je uloga znanosti. Istraživanje i inovacije će imati važnu ulogu u razvoju tih aktivnosti, podržati će ih nova zajednička poljoprivredna politika te kohezijska politika. Nužna je potpora stvaranju novog, hibridnog sveučilišnog kurikuluma te razvoj interdisciplinarnih kompetencija u širokom rasponu područja, uključujući znanosti o životu (life sciences), prirodne znanosti, inženjerska znanja, poslovanje, gospodarstvo, obrazovanje i društvene znanosti. Europska komisija u novoj strategiji razvoja bioekonomije naglašava kako može poticati istraživanja u bioekonomiji, jačati financiranje, ali može također djelovati kao katalizator u olakšavanju umrežavanja i razmjene najboljih praksi među zemljama članicama i regijama. Potrebno je primjenjivati regionalni pristup s obzirom da bioekonomija može značajno doprinijeti budućem razvoju ruralnih i obalnih područja. Jačanje bioekonomije, posebno u ruralnim i pogodnim šumskim područjima EU, predstavlja snažan razvojni potencijal u pogledu rasta i radnih mjesta.

Ključne riječi: bioekonomija, poljoprivreda

Croatia's agriculture and sustainable bio-economics

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Abstract

Traditional bio-economics is not new - we are known as agriculture and forestry or the agri-food system. The current agri-food system is not sustainable because it produces about 20-25% of greenhouse gas emissions that cause climate change; caused the soil degradation in the part of the treated soil; consumes about 70% of the total water we use, exaggerated by the use of mineral fertilizers and pesticides that cause large pollution of rivers, lakes and coastal areas and is responsible for forestry, wetland and biodiversity loss. Agriculture of the future, when it is not yet present, is one that needs to meet the needs of existing and future generations while ensuring profitability, environmental protection and social and economic equality. In the Republic of Croatia, no sustainable agriculture from the 1970s was introduced as an efficient system, showing poor resource use, reduced production and market producers, as well as food imports and a fall in agricultural share in GDP. Therefore, it will be more difficult to determine the place of agriculture in the biochemistry and bio-economics in agriculture and rural development. Sustainable bioeconomics means production from renewable biological resources (from soil and sea) and conversion of products and waste materials into food, bioproducts and bioenergy. It covers agriculture, forestry, fisheries, food and paper production, parts of the chemical and biotechnology industry and energy production. The greater use of renewable sources is no longer just one of the options but the necessity. Europe must be transformed from a society developed on fossil raw materials into biotechnology society, and the driving forces of this process are research and innovation, which gives a good opportunity to the academic community, especially from the biotechnical field. The process of transitioning economics to biochemistry is important for the environment as well as for food and energy security, but also for the overall competitiveness of Europe in the future. Implementation of multidisciplinary education programs across the EU is needed, which should result in increased opportunities for both high and low skilled workforce. Throughout the process, the role of science is important. Research and innovation will play an important role in the development of these activities, supported by a new common agricultural policy and cohesion policy. It is necessary to support the creation of a new hybrid university curriculum and the development of interdisciplinary competences in a wide range of areas including life sciences, natural sciences, engineering knowledge, business, economics, education and social sciences. The European Commission in its new strategy for the development of bio-economics emphasizes that it can stimulate research in bio-economics, strengthen funding, but it can also act as a catalyst to facilitate networking and exchange of best practices between member states and regions. It is necessary to apply a regional approach as bioeconomics can significantly contribute to the future development of rural and coastal areas. The expansion of bio-economics, especially in rural and suitable forests in the EU, is a powerful developmental potential in terms of growth and jobs.

Key words: bioeconomics, agriculture

A sustainable biomass supply for the growing bioeconomy

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Abstract

Climate change and the ongoing depletion of fossil resources emphasize the need for a shift from a fossil-based economy to a bioeconomy based on renewable resources. Demand for biomass will increase significantly through the implementation of novel biobased value chains, including biobased energy carriers, biobased materials and chemicals. However, as the debate about the sustainability of first generation biofuels shows that the biobased alternatives are not per se more environmentally friendly than their fossil-based counterparts. In addition, the growing demand for biomass for energetic and material use bears the risk of competition with food production. One solution for these problems could be the utilization of perennial crops, such as miscanthus or switchgrass, which often have a better environmental performance in comparison to conventional annual crops. In addition, perennial crops can be cultivated on marginal land, which is unsuitable for the production of food crops. Therefore, an environmental sustainability of several perennial crop-based value chains need to be assessed. Hereby strong focuses are the environmental hot spots of cultivation and utilization of biomass, as well as potential improvement options. In addition, the environmental performance of these value chains was compared to a fossil reference. The results of these assessments showed, that there is a significant net benefit for the environment in several impact categories when fossil-based products are substituted with biobased alternatives.

Key words: bioeconomy, sustainability, perennial crops, environmental performance, marginal land

World trends, new agricultural practices and scientific backgrounds of organic farming

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Abstract

Organic farming (OF) become a regular part of agriculture, therefore the aims are to represent the trends, practices and scientific backgrounds. The fact is that exist 178 countries, where organic agriculture increased land from 11 million hectares in 1999 to 57.8 million hectares in 2016, involved in total 2.7 million producers and more than 80 billion euros in market. The five largest areas of organic land are in Australia, Argentina, China, United States of America and Spain. The largest share of organic agricultural land in Europe (average 2.7%) reached Lichenstein, Austria and Estonia, 37.7%, 21.9% and 18.9%, respectively in comparison with Croatia 6.0% and Slovenia 9.0%. The total year growth (2014/2015) of organic land in the world is aprox. 6.5 mio hectares per year. Official agricultural practices follows International Federation of Organic Farming Movements (IFOAM) principles and national regulations. OF in EU is covered with Council Regulation (EC) No. 834/2007 and after 1.1. 2021will apply the new Council Reg. 848/2018. The new regulation will bring 75 new definitions for all sectors; new rules for plant and animal production, algaes, aquaculture, processed food, feed, wine and yeast; and the new rules for production of game animals and rabbits. Additional to basic principles (no synthetic chemicals, no GMO organisms, no industrial animal production, etc.) many interdisciplinary positive activities (regulated and researched) are taken into account, like care for organic matter, biodiversity, adoptions to climate changes, etc. According to activities of IFOAM the special attention was given to further development, similar activities provide TP Organics –European technology platforms for organic food and farming. During the last 10-year period an extensive data collection of OF papers was published. The data shows that key words organic food contain 384,733 papers in Sci Direct and 1791 in Sci (WoS), and OF 49,679 papers (incl. about 16 meta-analysis) and 2655 papers (incl. about 70 meta-analysis), respectively. Special attention was done to quality of organic food, cultivation practices and environmental impacts like biodiversity and foot prints. The data from Univ. Maribor shows high percentage of organo-phosphorus insecticides in urine after digestion conventional diet vs. organic food. Our data shows 4 to 6 times lower food prints in organic cultivation systems of field crops and vegetables than in conventional system and many positive effects on soil properties, and growth of crops in the fields using roller crimper in OF instead of conventional tillage systems, especially in climate changing conditions. Special attention was took into account of usable functional biodiversity with many positive effects on ecological services and social situation of small farm holders.

Key words: organic farming, organic agriculture, organic food, biodiversity, ecological services

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Travnjaci s crnkastom šiljevinom (*Schoenus nigricans* L.) na planini Obruč (sjeverozapadni Dinaridi)

Sonja ŠIŠIĆ, Marko RANDIĆ

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Sažetak

Javna ustanova „Priroda“ već nekoliko godina provodi istraživanja travnjačke vegetacije na planini Obruč. Obruč je botanički važno područje (IPA) uvršteno u mrežu Natura 2000. Utvrđeno je da se ovdašnje zajednice mediteransko-montanih travnjaka mogu detaljnije raščlaniti - što je bio glavni cilj istraživanja, pa se može izdvojiti nekoliko biljnih zajednica koje ranije nisu bile poznate. Istraživanja prof. dr. Ive Horvata u sjeverozapadnim Dinaridima prepoznaju kompleks mediteransko-montanih pašnjačkih zajednica izloženih buri s prevladavanjem trave uskolisne šašike (Seslerietum juncifoliae s. lat.). Recentno istraživanje travnjaka provedeno u razdoblju od 2016. do 2018. godine u predjelu Brgudac/Zala/Vršine na južnim padinama Obruča uključivalo je standardne fitocenološke metode (Braun-Blanquetov pristup). Rezultati ukazuju da se na 500 – 600 m nadmorske visine, na pretežno južnim ekspozicijama i na različitim nagibima terena te na dolomitnoj geološkoj podlozi razrastaju i travnjaci iz istog vegetacijskog kompleksa u kojima, međutim, prevladava crnkasta šiljevina (Schoenus nigricans L.). Prema utvrđenom flornom sastavu travnjaci s crnkastom šiljevinom mogu se također detaljnije raščlaniti. Zbog smanjenog intenziteta ispaše ovaca ove travnjačke zajednice na planini Obruč izložene su sekundarnoj sukcesiji. Najčešće drvenaste vrste koje se naseljavaju u sastojine crnkaste šiljevine jesu Amelanchier ovalis Medik., Juniperus communis L., Fraxinus ornus L., Ostrya carpinifolia Scop. i Pinus nigra J. F. Arnold. Opaženo je da busene crnkaste šiljevine povremeno pasu konji koji se u ovim predjelima drže u slobodnoj ispaši.

Ključne riječi: travnjačka vegetacija, “Seslerietum juncifoliae“, planina Obruč, Schoenus nigricans, sekundarna sukcesija

Grasslands with black bog-rush (*Schoenus nigricans* L.) on Mount Obruč (north-western Dinarides)

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Abstract

Priroda Public Institution has carried out surveys of grassland vegetation on Mount Obruč for several years. Mount Obruč is a botanically important area (IPA) included in the Natura 2000 network. Therefore, it is important to get to know the local vegetation in more detail, which is the main aim of this paper. Previous research, carried out mainly by Professor Ivo Horvat in the north-western Dinarides, recognised the complex of Mediterranean-mountain pasture communities exposed to the bura wind, in which narrow-leaved moor grass (Seslerietum juncifoliae s. lat.) predominates. Research was carried out in the period from 2016 to 2018 using standard phytosociological methods (the Braun-Blanquet approach) on the southern slopes of Mount Obruč (the Brgudac/Zala/Vršine area). The results show that at 500-600 metres above sea level, on mostly southern exposures and on different inclines, as well as on dolomite geological bedrock, grasslands from the same vegetation complex grow, though with black bog-rush (Schoenus nigricans L.) predominating. On the basis of the determined floral composition, grasslands with black bog-rush can also be broken down in more detail. Because of the reduced intensity of sheep grazing, Seslerietum juncifoliae complex pastures on Mount Obruč are exposed to secondary succession. The most common woody species that encroach on stands of black bog-rush are Amelanchier ovalis Medik., Juniperus communis L., Fraxinus ornus L., Ostrya carpinifolia Scop. and Pinus nigra J.F. Arnold. It has been noticed that tussocks of black bog-rush are occasionally grazed on by the horses that are kept in the open air in these areas all year around.

Key words: grassland vegetation, Seslerietum juncifoliae, Mount Obruč, Schoenus nigricans, secondary succession

Modelling of the water movement in the soil - possible tool for protection of ground water

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Abstract

Groundwater represents more than 80 % of potable water consumption in Slovakia. Our biggest reservoir of high quality potable groundwater is located on Žitný Island (Rye Island) in Slovak republic. Not only this groundwater source, but also many other in Slovakia are situated in locations with very good conditions for plant production. Protection of water in the Slovak Republic is currently realized by these legislative defined zones: Water protection zones, Water resources protective zone, Sensitive zones and Vulnerable zones.

According to low acreage of agricultural and arable land per person (about 0.40 and 0.25 ha), the specific protective zones of water resources, which take almost 20 % territory of Slovak Republic, could not be take away from agricultural activity.

This paper analyse methods of groundwater source protection zones utilization in Slovak republic based on statistical evaluation of the retrospective modelling of the piston flow of infiltrating water in the given soil profiles and under different crop covers.

Statistical evaluation of the retrospective modelling of the piston flow of infiltrating water in the given soil profiles and under different crop covers can be used for:

1. more accurate localization of critical areas in the investigated protection zones in the term of possible agrochemicals losses to the ground water for every grown crop-plant.
2. estimation of the investigated grown crops numerical order from the point of view their influence on the input of the nutrients (agrochemicals) into the ground water
3. estimation of the „critical“ or „safe“ terms of agrochemicals application in the investigated protection zones, as a function of the soil properties (in the event of their inhomogenity) and the grown crops
4. estimation of the aplication dose of industrial fertilizers and manure

Key words: groundwater source protection, pollution, terms of agrochemicals application

Biofortifikacija kupusa (*Brassica oleracea* L.) selenom i cinkom

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Sažetak

Nedostatak selena i cinka u prehrani značajno utječe na zdravlje ljudi. Negativni utjecaj nedostatka i pothranjenost se mogu otkloniti povećanjem koncentracija i bioraspoloživosti mineralnih elemenata (biofortifikacija) u biljnim prehrambenim proizvodima. Cilj ovog istraživanja bio je odrediti utjecaj gnojidbe selenom i cinkom na koncentraciju oba elementa u listovima i glavici kupusa. Pokus s biofortifkacijom proveden je na dva slavonska lokaliteta u istočnoj Hrvatskoj. Mikroelementi su prije sadnje kupusa plitko uneseni na proizvodne površine u obliku vodenih otopina natrij selenata (10 g Se ha-1 u obliku Na2SeO4) i cinkovog sulfata (2,5 kg Zn ha-1 u obliku ZnSO4×H2O). Aplikacija selena rezultirala je statistički značajnim povećanjem koncentracije Se u listovima i glavi kupusa. Koncentracije selena u listovima bile su osam puta veće, a u glavici četiri puta veće nego u kontrolnim biljkama (642,4; 383,0 i 79,5 µg Se kg-1). Suprotno tome, biofortifikacija cinkom imala je zanemariv utjecaj na koncentraciju cinka u ispitivanom biljnom materijalu. Niti jedan tretman nije imao značajan utjecaj na prinos. Pokus je pokazao učinkovitost aplikacije natrij selenata na obogaćivanje biljnog materijala selenom i opravdava praktične i ekonomske aspekte biofortifikacije.

Ključne riječi: povrće, mikroelementi, pothranjenost, agronomska biofortifikacija

Biofortification of white cabbage (*Brassica oleracea* L.) with selenium and zinc compounds

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Abstract

Lack of selenium and zinc in a diet significantly affect human health. Negative influence of deficiencies can be remedied through increasing the concentrations and bioavailability of mineral elements (biofortification) in plant-food products. The aim of this study was to determine the influence of selenium and zinc fertilisation on the concentration of both elements in cabbage leafs and heads. The biofortification experiment was set in two different locations of Slavonia region in east Croatia. Elements in form of aqueous solutions of sodium selenate (10 g Se ha-1 as Na2SeO4) and zinc sulphate (2.5 kg Zn ha-1 as ZnSO4×H2O) were applied on the fields prior to the planting of cabbage. Selenium treatment indicated statistically significant effect on the concentration of the element in leaves and cabbage heads. The selenium concentrations in leafs were eight times higher and in whole heads four times higher than in control plants (respectively 642.4, 383.0 and 79.5 μg Se kg-1). On the contrary, zinc fortification reviled a negligible impact on the zinc concentration in tested plant material. Both treatments did not have a significant effect on yield. The experiment proved beneficial impact of selenium application on enriching the plant material in the element and justified practical and economical aspects of the treatment implementation.

Key words: vegetable, microelements, malnutrition, agronomic biofortification

An innovative management system in protected areas for the purpose of sustainable tourism

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Abstract

The Project called Central Europe Eco-Tourism: tools for nature protection (CEETO) aims at implementing an innovative system for tourism based on a participatory planning approach, to improve and implement sustainable use of natural resources, especially monitoring tools focused on sustainable tourism activities in different contexts.

The main goal of this paper is to present a project which aims to protect and enhance the natural heritage of Protected Area (PA) and Natura 2000 Network by promoting an innovative sustainable tourism planning model.

The project involves four phases: the diagnosis phase, the testing phase, the third phase is Creating CEETO guidelines and the final phase, the CEETO Network.

Through the testing phase the plan is to improve monitoring program on the Sljeme ski slope area at the Medvednica Nature Park. That will include determination of the state of environmental indicators (hydrological, climatological, soil and edaphic) by analysis of snow, water, air and soil as well as determination of the state of nature indicators (stream and wells fauna, meadow and lichenes biodiversity and invertebrates).

The CEETO project will help to improve the managing capacities of managers of protected areas as well as to raise awareness of the value managing tourism sustainably, of protecting Europe's natural heritage whilst bringing social and economic benefits. It will provide a Network that will become the instrument of future networking among PAs across Europe in order to develop common initiatives and projects.

Key words: CEETO projects, Sljeme ski slope, enviromental indicators, nature indicators, network

Otpornost prirodnih populacija kvržičnih bakterija na različite koncentracije fungicida i teških metala

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Sažetak

Proces biološke fiksacije dušika ima značajnu ulogu u održivoj poljoprivrednoj proizvodnji. Prvenstveno je značajan simbiozni odnos kvržičnih bakterija i mahunarki te se on nastoji primjenjivati putem predsjetvene bakterizacije mahunarki. Uspješnost bakterizacije ovisi o učinkovitosti sojeva kvržičnih bakterija, ali i o otpornosti sojeva na nepovoljne uvjete u tlu. Cilj ovog istraživanja je utvrditi djelovanje različitih koncentracija fungicida i teških metala na rast šesnaest sojeva kvržičnih bakterija vrste *Sinorhizobium meliloti* i *Rhizobium leguminosarum* bv. *viciae.* Rast sojeva praćen je na YMA podlozi koja sadrži različite koncentracije kadmija, bakra, mangana i cinka. Za ispitivanje utjecaja različitih koncentracija fungicida na bazi iprodiona, mankozeba, kaptana i kombinacije mankozeb+zoksamid korištena je filter-disk metoda. Rezultatima istraživanja potvrđeno je inhibitorno djelovanje fungicida mankozeba na rast svih ispitivanih sojeva, ali i otpornost ispitivanih sojeva na fungicid na bazi iprodiona. Fungicid mankozeb + zoksamid djelovao je inhibitorno na rast sojeva samo kod većih doza. Istraživani sojevi *R. l.* bv. v*iciae* i *S.meliloti* pokazali su dobar rast na svim apliciranim koncentracijama Mn iona, ali su značajno osjetljivi na prisutnost kadmija i bakra. Većina ispitivanih sojeva nije osjetljiva na niže koncentracije cinkovih iona. U nastavku istraživanja potrebno je provjeriti dobivene rezultate u vegetacijskom i poljskom pokusu pri čemu bi se ispitivao utjecaj fungicida i teških metala na nodulacijsku sposobnost i simbioznu učinkovitost sojeva.

Ključne riječi*:* predsjetvena bakterizacija, fungicidi, teški metali, sojevi *R. leguminosarum* bv.*viciae*, sojevi *S. meliloti*

Resistance of indigenous rhizobial populations to different fungicide and heavy metal concentrations

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Abstract

The process of biological nitrogen fixation has important role in sustainable agriculture production. In agriculture practice legume-rhizobia symbiosis is used throught pre-sowing legume inoculation. Highly efficient rhizobial strain and also resistant to unfavorable soil conditions are crucial for successful legume inoculation. In this study, the impact of different fungicide and heavy metals concentration on growth of sixteen *Sinorhizobium meliloti and Rhizobium leguminosarum* bv. *viciae* strains was analysed. The strains growth on YMA medium containing different concentrations of cadmium, copper, manganese, zinc was determined. The effect of fungicide iprodione, mancozeb, kaptan and a combination of mancozeb+zoxamide on strains growth was analysed using filter-disc method. The results showed that fungicide mancozeb inhibited the growth of all tested strains, but strains were also resisted to fungicide iprodion. The application of higher concentration of fungicide mancozeb+zoxamide inhibited strain growth. All tested *R. leguminosarum* bv. v*iciae* i *S.meliloti* strains are manganese resistant and resulted in increased bacterial growth at all manganese concentrations, but sensitive to copper and cadmium presence. Most of tested strains was tolerant to lower zinc concentration. For future work it is necessary to test nodulation and symbiotic efficiency of rhizobial strains after fungicide and haevy metal treatment in pot and field conditions.

Key words: pre-sowing inoculation, fungicide, heavy metals, *R. leguminosarum* bv. *viciae* strains, *S. meliloti* strains

Potrebe rajčice za vodom u različitim agroekološkim uvjetima na području Republike Hrvatske

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Sažetak

S obzirom na mogućnost uzgoja rajčice u različitim proizvodnim područjima te samim tim i u različitim agroekološkim uvjetima, cilj ovoga rada je utvrditi potrebu rajčice za vodom na reprezentativnim lokalitetima u okviru Republike Hrvatske. Potreba rajčice za vodom je određena pomoću računalnog programa „Hidrokalk" (izvorna metoda Palmer W.C., 1965., korigirana i kalibrirana prema Vidačeku Ž., 1981.), a relevantne podloge: vrijednost korisnih oborina prosječne i sušne (75%-tne vjerojatnosti pojave oborina) godine prema metodi USBR (United States Bureau of Reclamation, Smith M., 1992.) te referentna evapotranspiracija prema metodi Penman-Monteith pomoću računalnog programa „Cropwat 8.0". S obzirom na odabrane lokalitete (Tovarnik, Jagodnjak, Donji Miholjac, Belica, Ćepić polje, Sinjsko te Vransko polje) korišteni su meteorološki podaci Državnog hidrometeorološkog zavoda RH s najbližih meteoroloških postaja za tridesetogodišnje razdoblje. Istraživana tla pripadaju uglavnom odjelu hidromorfnih tala, izuzev lokaliteta Belica gdje su prisutna automorfna tla. S obzirom na relevantne podloge, može se zaključiti da je potreba rajčice za vodom gotovo ujednačena na području Istočne Hrvatske i da se kreće od 126,1-179,4 mm u prosječnoj do 272,5-309,6 mm u sušnoj godini. Najmanje potrebe ima rajčica na lokalitetu Belica (62,9 mm u prosječnoj i 172,2 mm u sušnoj), gotovo ujednačene na području Ćepić polja i Sinjskog polja (109,5-122,2 u prosječnoj i 207,1-231,4 mm u sušnoj godini). Najveće su potrebe rajčice za vodom na području Vranskog polja, gotovo 300 mm u prosječnoj i 432,8 mm u sušnoj godini.

Ključne riječi: rajčica, lokalitet, potreba za vodom

Water needs for tomato plants in different agroecological conditions in the Republic of Croatia

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Abstract

Considering the possibility of growing tomatoes in different production areas and therefore in different agroecological conditions, the aim of this paper is to determine the water needs for tomatoes at representative sites within the Republic of Croatia. Water needs for tomatoes was determined using the "Hidrokalk" computer program (the original method of Palmer WC, 1965, corrected and calibrated according to Vidaček Ž., 1981), and the relevant layers: the value of precipitation in average and dry year (75% probability of occurrence precipitation) according to the USBR (United States Bureau of Reclamation, Smith M., 1992) and reference evapotranspiration according to the Penman-Monteith method using the "Cropwat 8.0" computer program. Given the selected sites (Tovarnik, Jagodnjak, Donji Miholjac, Belica, Ćepić polje, Sinjsko and Vransko polje), the meteorological data from the nearest weather stations of the Croatian Meteorological and Hydrological Service for the thirty year period were used. The investigated soils belong mainly to the hydromorphic soil type, except for the Belica site where automorphic soils ere resent. Given the relevant layers, it can be concluded that the water need for tomatoes was almost uniform in the area of Eastern Croatia and ranged from 126.1-179.4 mm in average year to 272.5-309.6 mm in dry year. The minimum requirement for water had tomatoes at the site Belica (62.9 mm in average year and 172.2 mm in dry year), water needs were almost uniform in the area of Ćepić polje and Sinjsko polje (109.5-122.2 in average year and 207.1-231.4 mm in dry year). The highest water needs of tomatoes were determined in the area of Vransko polje, where water needs were almost 300 mm in average year and 432.8 mm in dry year.

Key words: tomato, location, water needs

Antropogeni utjecaj na sedimentaciju i sedimente u području delte rijeke Neretve

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Sažetak

Postanak područja delte rijeke Neretve posljedica je različitih geoloških procesa kroz dugi vremenski period: usijecanje doline rijeke Neretve u kršku podlogu tijekom razdoblja niže razine mora, oscilacije razine mora koje su bile posebno naglašene u periodu kvartara, procesi trošenja stijena drenažnog područja rijeke Neretve, transporta alumosilikatnog materijala rijekom i sedimentacije. Sastav i tip sedimenta koji grade današnju deltnu ravnicu i prodeltu izravna su posljedica tih procesa. Uz ove prirodne procese koji su se odvijali kroz stotine tisuća godina, značajan utjecaj na značajke sedimenta i samu deltu Neretve u zadnjih nekoliko stotina godina imaju i ljudi. U ovom radu predstavljeni su različiti antropogeni utjecaji i njihov intenzitet (hidro- i agromelioracije, gradnja akumulacija i hidrotehničkih objekata na Neretvi, Trebišnjici i gornjim horizontima, geokemijske promjene u tlu, salinizacija i porast morske razine), s ciljem procjene kako će ljudski utjecaj u kombinaciji s onim prirodnim, utjecati na daljnje promjene (progradaciju/degradaciju) deltnog područja. Rezultati istraživanja sedimentnih jezgri iz deltne ravnice rijeke Neretve, pokazuju izrazitu promjenu u veličini zrna sedimenta. Šljunkoviti i pjeskoviti sedimenti nalaze se u većim dubinama i odgovaraju aluvijalnim sedimentima pleistocenske starosti, na koje su se kasnije tijekom holocena istaložili sitnozrnatiji transgresivni sedimenti (sitni pijesak, prah i glina) u nekadašnjem krškom estuariju rijeke Neretve. Najplići dijelovi deltne ravnice predstavljaju brzu progradaciju delte unutar estuarija Neretve u zadnjih 6000-7000 godina. Ipak, ta progradacija je usporena djelovanjem čovjeka u zadnjih 100 godina.

Ključne riječi: delta, antropogeni utjecaj, sediment

Anthropogenic influence on sedimentation and sediments in the area of the Neretva River delta

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Abstract

The development of the Neretva delta area is result of various geological processes during longer period: incision of the Neretva River into karstic basement during periods of lower sea level, sea level oscillations, which were particularly pronounced during Quaternary period, weathering processes of the rocks in the drainage area of the Neretva River, transport of alumosilicate material by the river and sedimentation. Composition and type of sediment, which filled recent delta plain and prodelta, are direct consequence of these processes. However, beside these natural processes that have been shaping Neretva River delta area during several hundreds of thousands years, human influence has been important as well, in the last few hundred years. In this research, various anthropogenic influences and their intensity have been presented (hydro- and agromelioration, building of hydroacummulation on the Neretva River, Trebišnjica River and Upper Horizons, geochemical changes in the soil, salinization and sea level rise), with the aim to establish and estimate in which ways human influences, in combination with the natural processes, will affect further changes (progradation/degradation) of the delta area. Results of grain size analyses in the sediment cores from the Neretva River delta plain showed significant changes in grain size. Deeper layers are composed of alluvial gravels and sands of Pleistocene age, atop which fine-grained transgressive sediments were deposited (fine sand, silt and clay) in the former karstic estuary of Neretva. The top layers of the delta plain represents fast progradation of the intra-estuarine Neretva delta in the last 6000-7000. However, in the last hundred years this progradation has been slowed down by human impact.

Key words: delta, anthropogenic influence, sediment

Modeliranje transporta glifosata pri različitim agroekološkim uvjetima upotrebom lizimetara i kolona s tlom

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Sažetak

Primjena pesticida u poljoprivrednoj proizvodnji može uzrokovati degradaciju kvalitete tla i vodnih resursa ukoliko dođe do njihova procjeđivanja u dublje horizonte tla i vode. Glifosat je herbicid koji se koristi za suzbijanje jednogodišnjih travnih i širokolisnih korova te višegodišnjih korova. Iako glifosat ima veliku sposobnost adsorpcije u tlu, njegov transport do površinskih ili podzemnih voda ipak je moguć. Cilj istraživanja je bio utvrditi način transporta glifosata u tlu pri različitim agroekološkim uvjetima. Poljski pokus je postavljen na dvije lokacije: Jazbina (brdsko područje na teksturno teškom tlu) i Baštica (dolinsko područje na teksturno lakšem tlu). Na obje lokacije su postavljeni senzori za praćenje vodne bilance tla, procjedni lizimetri i meteorološka postaja te uzete kolone s tlom u neporušenom stanju. Na kolonama je u kontroliranim uvjetima apliciran glifosat i vršeno ispiranje. Nakon prikupljenih podataka o toku vode i transportu glifosata, provedeno je numeričko modeliranje pomoću HYDRUS 2D/3D programa. Očekivano, visoki koeficijenti adsorpcije uslijed povećanog udjela gline i organske tvari uglavnom su limitirali transport glifosata u dublje horizonte tla. Međutim, utvrđeno je i da su glavni procesi transporta glifosata bili površinsko otjecanje (lokacija Jazbina) te preferencijalni tokovi (lokacija Baštica). Rezultati upućuju da unatoč relativno visokoj adsorpciji u tlu, herbicidi predstavljaju potencijalnu opasnost za kvalitetu vodnih resursa.

Ključne riječi: pesticidi, ispiranje, numeričke simulacije, vodni resursi

Modeling glyphosate transport in soils under different agricultural conditions using lysimeter and soil column data

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Abstract

Use of pesticides in agricultural production can lead to soil and water quality degradation if their leaching into deeper soil horizons or water occurs. Glyphosate is a herbicide used in control of certain annual and perennial grasses and broadleaf weeds. Although glyphosate adsorbs relatively strongly in the soil, its transport and presence in surface and ground water has been observed. Thus, the aim of research was to determine glyphosate soil transport in different agricultural conditions. Field experiment was set on two locations: Jazbina (hillslope terrain with a heavy soil texture) and Baštica (flat terrain with a light soil texture). On both locations, sensors for determination of soil water balance, lysimeters and meteorological station were installed and undisturbed soil columns are taken. Glyphosate was applied to soil columns after which columns were irrigated with water. After collecting the soil water flow and glyphosate transport data, numerical modeling with HYDRUS 2D/3D software was performed. As expected, relatively high soil adsorption coefficients resulting from high soil clay and organic matter content limited glyphosate transport into deeper soil horizons. However, data also confirmed that the main glyphosate transport processes were surface runoff (for Jazbina location) and transport by soil water preferential flow (for Baštica location). Thus, results suggest that even if highly adsorbed in the soil, herbicides still pose a potential threat to water quality.

Key words: pesticides, leaching, numerical modeling, water resources

Izolacija i identifikacija entomopatogenih nematoda na poljoprivrednim površinama u Hrvatskoj

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Sažetak

Entomopatogene nematode (EPN) zemljišne su nematode koje parazitiraju brojne kukce i obećavajuća su alternativa kemijskim insekticidima. Do danas su izdvojene iz tala različitih struktura i različitih staništa, uključujući pašnjake, šume i poljoprivredne usjeve. Različite vrste i sojevi EPN pokazuju različitosti u preživljavanju, infektivnosti i reprodukciji, koje ih čine više ili manje učinkovitima. Primjena endemskih EPN predstavlja manji rizik za neciljane organizme u odnosu na introducirane vrste. Cilj ovoga istraživanja bio je utvrditi postojanje EPN na poljoprivrednim površinama u Hrvatskoj te izolirati endemske sojeve EPN, koji bi mogli biti učinkovitiji u suzbijanju štetnika u odnosu na komercijalne vrste. Tijekom 2017. i 2018. g. prikupljeno je 75 uzoraka tla iz 15 lokaliteta s područja 5 županija (Bjelovarsko – bilogorska, Grad Zagreb, Koprivničko – križevačka, Virovitičko – podravska i Vukovarsko – srijemska), u usjevima kukuruza, soje i krumpira, nasadima jabuke i lijeske te pašnjacima. Primjenom metoda „Galleria bait“ i „White trap“ i molekularne dijagnostike, EPN iz roda Steinernema izdvojene su iz jednoga uzorka tla, prikupljenoga u usjevu kukuruza u lokalitetu Karane (46°01'08.8"N 16°31'31.7"E) u Koprivničko – križevačkoj županiji. Prema literaturnim podacima, EPN se utvrđuju u tek 3% prikupljenih uzoraka tla. Kako bi se izolirao veći broj vrsta i endemskih sojeva EPN, intenzivirat će se prikupljanje i analiza uzoraka tla.

Ključne riječi: entomopatogene nematode, Hrvatska, Steinernematidae, biološko suzbijanje

Isolation and identification of entomopathogenic nematodes on agricultural land in Croatia

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Abstract

Entomopathogenic nematodes (EPNs) represent a group of soil – inhabiting nematodes that parasitize a wide range of insects. They are a promising alternative to chemical insecticides. EPNs have been recovered from variety of soil textures and habitats, including pastures, forests and crop fields. Various species and strains of EPNs exhibit differences in survival, infectivity and reproduction that make them more or less efficacious. The use of endemic nematodes also may present less risk to nontarget organisms than introduced species. The aim of this work was to verify the occurrence of EPNs in agricultural land in Croatia and to isolate endemic EPNs, which could be more effective in pest control than commercial strains. In 2017 and 2018, 75 soil samples from 15 localities were collected in 5 Croatian counties (Bjelovarsko – bilogorska, Grad Zagreb, Koprivničko – križevačka, Virovitičko – podravska and Vukovarsko – srijemska) from corn, soya and potato crop, hazel and apple orchard and pasture. Using „Galleria bait method" and „White trap" and molecular biology analysis, EPNs belonging to genus *Steinernema* were recovered from one soil sample, taken in corn crop in the locality Karane (46°01'08.8"N 16°31'31.7"E) in Koprivničko – križevačka county. According to literature data, EPNs are found to be present in only 3% of the samples. In order to determine as many species and strains of EPNs as possible, more samples need to be collected.

Key words: entomopathogenic nematodes, Croatia, Steinernematidae, biological control

Rasprostranjenost invazivnih stranih biljnih vrsta na napuštenim poljoprivrednim površinama u zaštićenom području Parka prirode „Žumberak – Samoborsko gorje“

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Sažetak

Zaštićeno područje Park prirode „Žumberak – Samoborsko gorje“ smješteno je u sjeverozapadnoj Hrvatskoj, a obuhvaća površinu od oko 34 200 ha. Uslijed vegetacijske sukcesije i širenja invazivnih biljaka dolazi do gubitka bioraznolikosti, a to je posljedica smanjenja čovjekovog utjecaja u području zbog napuštanja tradicionalnog načina života i raseljavanja stanovništva. Tijekom tri ljetne sezone (2016., 2017. i 2018.) na području Parka inventarizirane su invazivne strane biljne vrste. Cilj istraživanja bio je zabilježiti prisutnost i udio invazivnih biljaka u ukupnoj flori područja, što je jedan od zadataka iz Plana upravljanja Javne ustanove koja upravlja zaštićenim područjem. Preliminarni podaci o prisutnosti invazivnih biljaka preuzeti su iz baze Flora Croatica Database. Područje Parka prirode podijeljeno je u MTB (Meβtischblätter) mrežu s jedinicama površine od 1.5x1.45 km (MTB 1/64), slijedeći predloženi nacionalni standard. U analizu rasprostranjenosti invazivne flore uključeno je 153 MTB 1/64 polja. Zabilježene biljne vrste određene su i analizirane s obzirom na životni oblik, mehanizam rasprostiranja sjemena i korištenje zemljišta na kojem su primijećene. Od ukupno 32 zabilježene svojte, na napuštenim poljoprivrednim površinama najčešće su *Erigeron annuus* (L.) Pers., *Ambrosia artemisiifolia* L., *Conyza canadensis* (L.) Cronquist i *Amaranthus retroflexus* L. Najveći broj po MTB polju zabilježen je u naseljenim područjima i kamenolomima, a najmanji na izoliranim šumskim travnjacima i travnjačkim površinama u sukcesiji.

Ključne riječi: *Erigeron annuus* (L.) Pers., *Ambrosia artemisiifolia* L., *Conyza canadensis* (L.) Cronquist, *Amaranthus retroflexus* L., Park prirode „Žumberak – Samoborsko gorje“

Distribution of invasive alien plant species on abandoned agricultural land in protected area of Nature Park “Žumberak – Samoborsko gorje“

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Abstract

The protected area of Nature Park "Žumberak – Samoborsko gorje" is situated in the northwestern Croatia, covering approximately 34 200 ha. There is a high probability of biodiversity loss under the influence of succession and the spread of invasive plant species in the area, due to decreasing anthropogenic influence, such as abandoning the rural way of life and emigration. During three summer seasons (2016, 2017 and 2018) invasive alien plant species have been systematically recorded in the area. The aim of this study was to determine the presence of invasive plant species in total flora of the protected area, as one of the tasks assigned in the Nature Park Administration's Management Plan. Preliminary data on the presence of the invasive plant species was taken from the Flora Croatica Database. The entire area of the Nature Park was divided into a MTB (Meβtischblätter) grid subdivided into 1.5x1.45 km units (MTB 1/64), according to the proposed national standard. A total of 153 MTB units were included in the analysis of the distribution of invasive flora. The determined species were analyzed with respect to their life form, the mechanism of seed dispersal and the type of land use where the individual taxa appear. Out of total of 32 invasive plant species recorded, the most widespread species found on abandoned agricultural land were *Erigeron annuus* (L.) Pers., *Ambrosia artemisiifolia* L., *Conyza canadensis* (L.) Cronquist and *Amaranthus retroflexus* L. The most of IAS per MTB 1/64 unit was found in populated areas and quarries, while the least was recorded in isolated forest grasslands and grasslands in succession.

Key words: *Erigeron annuus* (L.) Pers., *Ambrosia artemisiifolia* L., *Conyza canadensis* (L.) Cronquist, *Amaranthus retroflexus* L., Nature Park "Žumberak – Samoborsko gorje"

Prednosti k0-INAA metode za karakterizaciju uzoraka tla

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Sažetak

U usporedbi s ostalim spektrometrijskim metodama, nuklearne analitičke metode mogu imati nekoliko prednosti kod karakterizacije elementarnog sastava tla. U ovoj studiji je predstavljena instrumentalna neutronska aktivacijska analiza (INAA) s aspekta njene osjetljivosti, prilagodljivosti i visoke pouzdanosti. Neutronska aktivacijska analiza (NAA) je nuklearna analitička metoda koja koristi specifične karakteristike nuklearnih reakcija te tako omogućuje istovremeno određivanje brojnih elemenata u uzorku bez njegovog razaranja. NAA je jedna od najistaknutijih analitičkih metoda kod određivanja rijetkih zemnih elemenata i aktinida u uzorcima tla zbog vrlo malih interferencija matrice uzorka tijekom nuklearnih interakcija s uzorkom. Ideja o primjeni k_0-metode INAA (k_0-INAA) u analitičke svrhe započela je u ranim 1970. godinama kada su apsolutni nuklearni podaci zamijenjeni s k_0-faktorima koji su bili određeni eksperimentalno. Navedena analitička metoda koristi Au kao standard (u obliku Al-0.1%Au legure) koji je ozračen zajedno sa uzorkom. Metoda k_0-INAA je na Institutu "Jožef Stefan" uvedena i validirana sredinom 90-tih godina te se od tada koristi kod rutinskih analiza makro- i mikro-elemenata u različitim uzorcima iz okoliša korištenjem 250 kW TRIGA Mark II istraživačkog reaktora. Osim toga, k_0-INAA metoda je akreditirana i prema normi ISO/IEC 17025 za određivanje elementarnog sastava u uzorcima iz okoliša. U ovom radu je k_0-INAA metoda upotrijebljena u svrhu određivanja rijetkih zemnih elemenata i aktinida u uzorcima tla s dodatkom komunalnog mulja. Rezultati pokazuju da koncentracije La variraju od 17,4 do 59,7; Ce od 35,0 do 158,0; Nd od 17,1 do 54,8; Sm od 3,2 do 9,4; Eu od 0,7 do 2,0; Tb od 0,4 do 1,2 i Yb od 1,5 do 4,0 mg kg^{-1} suhe tvari. Koncentracije U bile su u rasponu od 1,5 do 4,1 mg kg^{-1} suhe tvari a koncentracije Th u rasponu od 5,6 do 27,3 mg kg^{-1} suhe tvari. Sukladno s potvrdom o akreditaciji prema normi ISO/IEC 17025 izdanom od strane Slovenske Akreditacije (br. LP-090) za k_0-INAA metodu svi su navedeni rezultati unutar raspona područja akreditacije, koji se za navedene elemente kreću od 0,005 mg kg^{-1} do 1000 mg kg^{-1}. Stoga možemo zaključiti da su glavne prednosti k_0-INAA metode niska granica detekcije i sastavljena standardna mjerna nesigurnost rezultata analize niža od 10%, što potvrđuje osjetljivost i pouzdanost ove metode za karakterizaciju uzoraka tla.

Ključne riječi: Rijetki zemni elementi, Aktinidi, Tlo, k_0-INAA, TRIGA reaktor

Advantages of the k0-INAA for characterization of soil samples

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Abstract

For soil elemental characterization, nuclear analytical methods may have several advantages compared to other spectrometric techniques. In this study, instrumental neutron activation analysis (INAA) is presented in terms of its sensitivity, versatility and high reliability. Neutron activation analysis (NAA) is a nuclear analytical technique that utilises the specific properties of nuclear reactions, thereby enabling simultaneous determination of numerous elements in a sample without its decomposition. Due to very small matrix interferences during neutron-sample interactions, NAA is one the most prominent analytical technique for the determination of rare earth elements and actinides in soil samples. The idea of using the k_0-method of instrumental neutron activation analysis (k_0-INAA) for analytical purposes appeared in the early 1970s, where the absolute nuclear data are replaced with k_0-factors that are experimentally determined. It uses Au as the standard (in form of an Al-0.1%Au alloy) irradiated together with a sample. The k_0-method at the Department of Environmental Sciences of the Jožef Stefan Institute (IJS) has been introduced in the middle 1990s and validated, and since then it has been used for routine analyses for determining micro and trace elements in different environmental samples using the 250 kW TRIGA Mark II research rector. In addition, the k_0-INAA technique has been accredited according to the ISO/IEC 17025 for determining elemental composition in environmental samples since 2009. In this work, the k_0-INAA technique was applied for the determination of rare earth elements and actinides in samples of sewage sludge-amended soil. The results revealed that concentrations of La, Ce, Nd, Sm, Eu, Tb and Yb varied from 17.4 to 59.7, 35.0 to 158.0, 17.1 to 54.8, 3.2 to 9.4, 0.7 to 2.0, 0.4 to 1.2 and 1.5 to 4.0 mg kg^{-1} dry weight, respectively. Concentrations of U and Th were within limits from 1.5 to 4.1 and 5.6 to 27.3 mg kg^{-1} dry weight, respectively. According to ISO/IEC 17025 accreditation certificate LP-090 given by Slovenian Accreditation for the k_0-INAA technique; all results are inside the accreditation ranges, which for above mentioned elements varied from 0.005 mg/kg to 1000 mg/kg. In conclusion, the low limit of detection and the combined standard uncertainty up to 10% of the measurement results confirmed the high sensitivity and reliability of the k_0-INAA for such applications.

Key words: Rare earth elements, Actinides, Soil, k_0-INAA, TRIGA reactor

Utjecaj malčiranja na režim vlažnosti hortisola u uzgoju salate

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Sažetak

Cilj ovog istraživanja bio je utvrditi utjecaj mrtvih organskih malčeva (neprerađena ovčja vuna – OV i „filcana" ekološka vuna – EV), crnog polietilenskog filma (PE) i nemalčiranog tla (NT) na režim vlažnosti hortisola u vegetaciji salate maslenke (tip Batavia), u proljetnom roku uzgoja (travanj-lipanj). Istraživanje je provedeno na pokušalištu Agronomskog fakulteta u Zagrebu 2017. godine, a pokus je postavljen prema slučajnom bloknom rasporedu u tri ponavljanja. Uzorkovanje tla (7 puta) obavljeno je dekadno sa dubina 0-10 cm i 10-20 cm, u 3 ponavljanja, a sadržaj vlage u tlu određen je gravimetrijskom metodom. Trenutačna vlaga tla tijekom vegetacije salate nije se spuštala ispod točke venuća (23,70 %vol). Na sadržaj trenutačne vlage u tlu statistički su značajno utjecali: dani nakon presađivanja salate na otvoreno (DNS) i malč (M). S obzirom na DNS, statistički najmanje vlage u tlu utvrđeno je kod 46 DNS (25,13 % vol u sloju 0-10 cm i 26,54% vol. u sloju 10-20 cm), a značajno više kod 5 DNS (38,87 % vol u sloju 0-10 cm, odnosno 37,74 % vol. u sloju 10-20 cm). S obzirom na M, na dubini 0-10 cm najviše vlage bilo je na PE (35,18 % vol), a najmanje na NT (31,29 % vol), dok razlika između PE i OV (34,76 % vol.) nije bilo. Na dubini 10-20 cm utvrđene su značajne razlike između PE (35,34% vol.) i OV (34,19 % vol) u odnosu na NT (31,66% vol.), dok statistički značajna razlika između EV (33,51% vol) i NT nije utvrđena. Dakle, u oba sloja tla trenutačna vlažnost se kretala slijedećim redom: PE > OV > EV > GT.

Od organskih malčeva primijenjenih u pokusu, OV se pokazala najboljom u čuvanju vlage tla, ali i ekološki prihvatiljivijom u odnosu na PE.

Ključne riječi: ovčja vuna, polietilenski film, vrtno tlo, vlaga tla, lisnato povrće

Effect of mulching onHortisol moisture regime in lettuce cultivation

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Abstract

The aim of this study was to determine the influence of the dead organic mulch (loose sheep wool -SW and nonwoven, ecological wool mat –EW), black polyethylene film (PE) and soil without mulch (WM) on the Hortisol moisture regime in the cabbage lettuce vegetation (type Batavia), during the spring cultivation period (April-June). The research was conducted on an experimental field at Faculty of agriculture in Zagreb, in 2017. Trial was set up as random block design in three replications. Soil sampling (7 times) was performed by decades with a depth of 0-10 cm and 10-20 cm in 3 replications and the soil moisture content was determined by gravimetric method. The current soil moisture content during the lettuce vegetation did not drop below the wilting point (23.70% vol). The current soil moisture content was significantly influenced by the days after the transplantation of lettuce on the field (DAT) as well as type of mulch (M). With regard to DAT, statistically the lowest value of soil moisture was found at 46 DAT (25.13% vol in 0-10 cm layer and 26.54% vol in layer 10-20 cm), and the significant higher value was recorded at 5 DAT (38.87 % vol in layer 0-10 cm and 37.74% vol in layer 10-20 cm). With respect to M, at the depth of 0-10 cm the highest moisture was at PE treatment (35.18% vol) and the lowest at WM (31.29% vol), while the differences between PE and SW (34.76% vol.) treatments were not found. At 10-20 cm soil depth significant differences in soil moisture were found between PE (35.34% vol.) and SW (34.19% vol) treatments compared to WM (31.66% vol.), but statistically significant differences between EW (33.51% vol) and NT were not determinated. Hence, in both soil layers the current soil moisture content were found in following order: PE> SW> EW> WM.

Among all organic mulches which are used in this trial, SW was proved to be the best in soil moisture conservation and also more ecologically acceptable than PE.

Key words: sheep wool, polyethylene film, hortisol, soil moisture, green vegetables

Health and Sport as a Forest Ecosystem Services in Protected Areas and Payment for Ecosystem Services (PES)

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Abstract

The multifunctional role of the forest is reflected in the preservation of the environment and biodiversity, the mitigation of the consequences of climate change, the preservation of the quality and quantity of drinking water and soil, and it creates the preconditions for the development of green economy. Demand for Forest Ecosystem Services (FES) is increasing, due to growing populations and socio-economic changes. The aim of the research is to valorise the health function of the FES and develop the Payment for Ecosystem Services (PES) methodology. Public Institution Nature Park Medvednica conducts research as part of the project "Spurring INnovations for forest eCosystem sERvices in Europe“. The research will be carried out for three years, in cooperation with stakeholders, through workshops whereby stakeholders will be actively involved. On the co-design workshop stakeholders have identified several mechanisms (One-time concession permits, Donation boxes, Application model) that will be further improved and tested in the field. Also the survey on the willingness to pay for FES is conducting. The results obtained by analyzed questionnaires and compared with the already existing parameters will be the basis for developing the PES methodology. This research should raise public awareness on the health benefits of FES and FES in general. It is well known that the FES are ten times larger than the economic value of the wood mass. Developed PES methodology will provide resources to maintain existing content and infrastructure in Nature Park Medvednica and finance new ones.

Key words: stakeholder, forest, valorisation, health function, payment for ecosystem services (PES).

Isolation and characterization of endophytic bacteria from soybean (*Glycine max* L.)

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Abstract

Endophytic bacteria colonize the inside of the tissue without causing any negative effects. The main aim of this study was to genotypically and phenotypically characterize endophytic bacteria isolated from roots, stems and nodule of two soybean cultivars (AFZG Ana and Gabriela). A total of 29 endophytes were isolated from three different tissues – root, nodule and stem. Genotypic characterization included rrs genes sequencing. Five different genera of bacteria were identified: Pseudomonas spp., Sphingomonas spp., Bradyrhizobium spp., Rhizobium spp., and Agrobacterium spp. Most of the isolates were Gram negative, rod-shaped, without capability of capsule production. The variability of the phenotypic characteristics of isolates was demonstrated, as well as the resistance to adverse environmental conditions such as high temperature, increased salt content, and low and high pH values. Most strains showed tolerance to the specific antibiotics. Most of the catalase positive isolates belong to Bradyrhizobium or Rhizobium spp., while the catalase negative isolates belong to the Pseudomonas, Sphingomonas and Agrobacterium spp. It was shown that 85% of the tested isolates do not respond to the enzyme oxidase while those that react to the enzyme belongs to the Pseudomonas spp. Further characterization of endophytes is needed to determine their influence on plant growth.

Key words: endophytic bacteria, soybean (Glycine max L.), 16S rRNA gene sequencing, phenotypic characterization

Utjecaj mineralne ishrane borom na fenolni sastav lista masline

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Sažetak

Fenolni spojevi su glavni bioaktivni spojevi lista masline s dokazanim antikancerogenim, protuupalnim i antimikrobnim djelovanjem. Iako je poznato da gnojidba utječe na sastav fenola, tek je nekoliko istraživanja usmjereno na proučavanje utjecaja mineralne ishrane na sastav fenola lista masline.

Cilj ovog rada bio je istražiti utjecaj gnojidbe borom (B) na fenolni sastav lista masline. Pokus je postavljen u zaštićenom prostoru na jednogodišnjim sadnicama masline sorte Istarska bjelica. U tri gnojidbena tretmana korištena je modificirana Hoglandova otopina s različitim molarnim koncentracijama B (B0 (0 μM B), K (7.5 μM B) i B+ (30 μM B)). Nakon dva mjeseca tretman (B0) pokazao je najveći utjecaj na sadržaj verbaskozida u listu masline u odnosu na ostale tretmane, dok se ukupni fenoli nisu razlikovali između tretmana. Koncentracija cinka (Zn) i litija (Li) bila je značajno veća u listu masline kod primjene standardne hranjive otopine (K) u odnosu na (B0) i (B+) tretman. Koncentracija B u lišću bila je veća kod (K) i (B+) tretmana u odnosu na (B0), dok je koncentracija B u korijenu bila značajno veća u (B+) tretmanu u odnosu na sve ostale tretmane. Koncentracije P, K, Ca, Mg, Na, Fe, Mn, As, Cu, Pb, Al i Ba nisu se mijenjale pod utjecajem primijenjenih tretmana.

Ključne riječi: cink, Hoglandova otopina, Istarska bjelica, *Olea europaea* L., verbaskozid

Boron mineral nutrition and its impact on olive leaf phenolics

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Abstract

Phenolic compounds are considered to be the main bioactive compounds in olive leaf and their anticancer, anti-inflammatory and antimicrobial activity are well documented. Although mineral nutrition effect on plant phenolic compounds is well known, there are only few publications focused on its impact on olive leaf phenolics.

Thus, the aim of this paper was to determine the impact of boron (B) fertilization on olive leaf phenolic profile. One-year old *Olea europaea* L. cv. Istarska Bjelica seedlings were planted in the greenhouse experiment with three different fertilization treatments. Each treatment was based on the modified Hogland solution and different molar B concentrations (B0 (0 μM B), C (7.5 μM B) and B+ (30 μM B)) were used. After two months the (B0) treatment had the highest impact on verbascoside content in olive leaves compared to other applied treatments. The total phenols did not differ between different B fertilization regimes. Zinc (Zn) and Lithium (Li) concentrations in the olive leaf were significantly higher in the standard nutrient solution (C) compared to (B0) and (B+) application. B concentration in olive leaves was higher in (C) and (B+) treatments related to (B0), while B concentration in the olive roots was significantly highest in (B+) treatment. Concentrations of P, K, Ca, Mg, Na, Fe, Mn, As, Cu, Pb, Al and Ba were not modified under different B treatments.

Key words: zinc, Hogland solution, Istarska bjelica, *Olea europaea* L., verbascoside

Sadržaj kloroplastnih pigmenata i fenola u soku pšenične trave (*Triticum aestivum* L.)

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Sažetak

Mladi izdanci pšenice (*Triticum aestivum* L.) koji se mogu koristiti kao dodatak prehrani nazivaju se pšeničnom travom. Sok klijanaca je bogat klorofilima, fenolima i ostalim antioksidativnim komponentama, zbog čega se smatra funkcionalnom hranom. Klorofil predstavlja bogat izvor bioraspoloživog magnezija koji je vezan na porfirinsku jezgru na-sličan način kao što je željezo vezano u hemskoj strukturi. Fenolni spojevi su sekundarni metaboliti biljaka velike antioksidacijske aktivnosti. Cilj istraživanja je bio utvrditi postoje li razlike u sadržaju kloroplastnih pigmenata i fenola u soku pšenične trave kod pet hrvatskih, pet mađarskih i pet srpskih sorti, uzgajanih u kontroliranim uvjetima. Veći omjer klorofila a/b je u prosjeku utvrđen kod hrvatskih i mađarskih sorti u usporedbi sa srpskim sortama, a najveći prosječni sadržaj fenola je utvrđen u skupini hrvatskih sorata. Kod svih petnaest ispitivanih sorata, utvrđen je najveći sadržaj klorofila i karotenoida kod sorte Žitarka, a najveći sadržaj fenola kod sorte Srpanjka. Najviši sadržaj klorofila i karotenoida u skupini mađarskih sorata je utvrđen kod sorte Csardas, a fenola kod sorte MV Emese. U skupini srpskih sorata, sorta Pesma se isticala najvećim sadržajem kloroplastnih pigmenata, dok je kod sorte Sremica utvrđen najviši sadržaj fenola. Dobiveni podatci pokazuju da se već kod mladih klijanaca pšenične trave ističe sortna specifičnost u sadržaju kloroplastnih pigmenata i fenola te je pravilan odabir sorte kod kućnog uzgoja ovog funkcionalnog dodatka prehrani, jako bitan.

Ključne riječi: pšenična trava, kloroplastni pigmenti, fenoli

The content of chloroplastic pigments and phenols in a juice of wheat grass (*Triticum aestivum* L.)

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Abstract

Young seedlings of wheat (*Triticum aestivum* L.) that can be used as a dietary supplement, are called wheat grass. Its juice is rich in chlorophylls, phenols and other antioxidant components, which is why it is considered a functional food. Chlorophyll is a rich source of bioavailable magnesium bounded to the porphyrin core in a similar way as iron is bounded to the hemium structure. Phenolic compounds are secondary metabolites of plants with high antioxidant activity. The aim of the research was to determine whether there are differences in the content of chloroplast pigments and phenols in wheat grass in five Croatian, five Hungarian and five Serbian cultivars, grown under controlled conditions. The highest ratio of chlorophyll a/b is found in Croatian and Hungarian cultivars in comparison to Serbian cultivars, and the highest average content of phenols was found in the group of Croatian cultivars. In all fifteen examined cultivars, the highest content of chlorophylls and carotenoids was found in the cultivar Žitarka, and the highest content of phenols in the cultivar Srpanjka. The highest content of chlorophylls and carotenoids in the group of Hungarian cultivars was found in the Chardas cultivar, and phenols in the cultivar MV Emese. In the group of Serbian cultivars, the Pesma cultivar was characterized by the highest content of chloroplastic pigments, while the highest content of phenols was found in the Sremica cultivar. The data obtained show that even in young seedlings of wheat, the specifity in chloroplastic pigments and phenols content is highlited and the correct selection of cultivar for domestic growing of this functional dietary supplement, is very important.

Key words: wheat grass, chloroplastic pigments, phenols

Effect of multi-mycotoxin exposure of *Fusarium* mycotoxins on glutathione redox system in poultry

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Abstract

Fusarium mycotoxins - T-2 toxin, its active metabolite HT-2 toxin, deoxynivalenol (DON) and fumonisin B1 are commonly found in feed commodities, which are known to initiate oxidative stress which is neutralized by the glutathione system within the antioxidant defence system, depending on the dose and duration of exposure.

In present study, the intracellular biochemical and gene expression changes were investigated in case of multi-mycotoxin exposure, with attention to certain elements of the glutathione system. In vivo study was performed in laying hen in a short-term (72 hours) feeding trial with medium (T-2 toxin: 0,25mg/kg; DON: 5 mg/kg; fumonizin B1: 20 mg/kg) and high doses (T-2 toxin: 0,5mg/kg; DON: 10 mg/kg; fumonizin B1: 40 mg/kg) of multi-mycotoxin exposure. The amount (reduced glutathione-GSH) and activity (glutathione peroxidase-GPx) of the glutathione system was measured as antioxidant markers in the liver. Changes in gene expression of glutathione peroxidase4 (GPx4), glutathione synthetase (GSS), and glutathione reductase (GSR) were also measured.

The multi-mycotoxin exposure affected glutathione system, which was supported by the significantly higher GSH concentration in the medium dose on the day 1 compared to the control. GPx4 and GSS expression was elevated on day 1 in the same group and on day 2 in the high dose group, but decreased later. GSR expression elevated on day 1 and decreased on day 2 in the medium and high dose groups. In regard to the obtained results, the individual effects of the Fusarium mycotoxins may be interfered by the composite toxicity of multi-mycotoxin exposure.

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Keywords: Fusarium, multi-mycotoxin, glutathionesystem, poultry

Utjecaj uzgoja ratarskih kultura na onečišćenje voda Bid-bosutskoga polja

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Sažetak

Istočna Slavonija i Zapadni Srijem spadaju u Istočno panonsku poljoprivrednu podregiju, a tradicionalno se nazivaju i žitnica Hrvatske. Ovo područje odlikuje se plodnim tlima i (čistom) vodom, ali intenzifikacija biljne i stočne proizvodnje, primjena agrokemikalija i napuštanje plodoreda sve više utječe na onečišćenje voda u vodotocima i podzemnim izvorima pitke vode. Istraživanja provedena u Bid-bosutskom polju (2009-2013) imala su za cilj utvrditi stanje površinskih, procjednih i podzemnih voda i intenzitet onečišćenja uzrokovanog gnojidbom N i P kao najvažnijih hranjiva ratarskih kultura. Prema dobivenim rezultatima utvrđeno je da je u vodotocima Bid i Istočna Berava u znatnoj mjeri povećan sadržaj spojeva NH4-N i P te je uz aktualni sustav gospodarenja, voda u njima izložena ozbiljnom riziku od eutrofikacije. Srednje vrijednosti koncentracije ukupnoga N i P u perkolatu lizimetara povremeno su prelazile maksimalno dopuštene koncentracije (MDK), od 11,3 mg N/l, odnosno 0,3 mg P/l. Valja također naglasiti da je podzemna voda u solumu poljoprivrednih tala, prema utvrđenim vrijednostima i kriterijima koji su propisani Uredbom o klasifikaciji voda (Narodne novine, br. 77/98. i 137/08.), odgovarala III. kategoriji ekološke kakvoće. Rezultati višegodišnjih istraživanja na području Bid-bosutskog polja pokazali su da plodored s visokom zastupljenošću okopavina te visokim količinama dodanih gnojiva u neprimjereno vrijeme predstavlja opasnost ozbiljnog onečišćenja vodnog blaga ovog područja dušikom i fosforom.

Ključne riječi: poljoprivreda, voda, onečišćenje, dušik, fosfor

The influence of field crops cultivation on water pollution in Bid-bosut field

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Abstract

Eastern Slavonia and Western Srijem fall into the East Pannonian agricultural subregion, and traditionally are called the granary of Croatia. This area is characterized by fertile soils and (pure) water, but the intensification of plant and livestock production, the application of agrochemicals and the abandonment of crops rotation are increasingly affecting water pollution in watercourses and underground drinking water sources. The research was carried out in the Bid-bosut field (2009-2013) aimed to identifying the water status and the intensity of contamination caused by fertilization of N and P as the most important crop nutrients. According to the results it was found out that in the watercourses Bid and East Berava the content of NH4-N and P compounds has been considerably increased, and with the current management system, water is exposed to a serious risk of eutrophication. Mean concentrations of total N and P in the lysimeter percolate periodically exceeded the maximum allowed concentration (MAC) of 11.3 mg N/l or 0.3 mg P/l. It should also be emphasized that groundwater in the agricultural soils, according to the values and criteria laid down by the Water Classification Regulation (Official Gazette, No. 77/98 and No. 137/08), corresponded to III. ecological quality category. The results of several years of research in the Bid-bosut field have shown that crop rotation with high amounts of fertilizers added in inappropriately time presents a serious risk for contamination of water with nitrogen and phosphorus.

Key words: agriculture, water pollution, nitrogen, phosphorus

Biofortifikacija matovilca selenom pri uzgoju u kontejnerima

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Sažetak

U mnogim područjima u svijetu koncentracija Se u tlu je mala, što utječe na razinu Se u krmi i hrani te, posljedično, na zdravlje životinja i ljudi. U prethodnim su istraživanjima različiti autori objavili da je prosječan dnevni unos Se u istočnoj Hrvatskoj vrlo nizak te da biofortifikacija može ublažiti pothranjenost selenom. Cilj je ovog istraživanja utvrditi uspješnost biofortifikacije matovilca (*Valerianella locusta* L.) uzgajanog u kontejnerima dodavanjem Se u različite medije za uzgoj. Pokus je proveden uzgojem matovilca u kontroliranim uvjetima u tri različita medija (komercijalni medij na bazi bijelog treseta, vermikompost i 1:1 smjesa komercijalnog medija i vermikomposta) u sjetvenim kontejnerima s volumenom 52 mL po sjetvenom mjestu. Biofortifikacija Se provedena je dodavanjem 15 mL 40 µM otopine Na_2SeO_4 u medij 40 dana nakon sjetve. Medij je značajno utjecao na prinos matovilca jer je najveći prinos ostvaren uzgojem na komercijalnom mediju i na 1:1 smjesi s vermikompostom, a značajno niži uzgojem na čistom vermikompostu. Biofortifikacija nije utjecaja na prinos. Utjecaj medija i biofortifikacije na koncentracije Se bio je suprotan, nije utvrđen utjecaj medija, a aplikacija Se rezultirala je 173 puta većom koncentracijom Se u matovilcu nego u kontrolnom tretmanu (1123,6 prema 6,5 µg Se kg^{-1} u svježoj tvari). Rezultati dokazuju veliki potencijal biofortifikacije jer je za preporučeni dnevni unos selena (55 µg) dovoljno konzumirati 48,9 g svježeg biofortificiranog matovilca ili 8.461,5 g matovilca bez biofortifikacije.

Ključne riječi: pothranjenost, selen, matovilac, vermikompost, agronomska biofortifikacija

Selenium biofortification of lamb's lettuce grown in containers

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Abstract

In many areas of the world, the concentration of Se in soil is low, which affects level of Se in feed and food plants and accordingly animal and human health. A very low average daily Se intake in human nutrition was earlier reported for eastern Croatia, and biofortification could mitigate Se malnutrition. The aim of this study was to analyze Se biofortification of lamb's lettuce (*Valerianella locusta* L.) grown in containers by adding the Se in different growth medium. The experiment was set with three different growth medium (commercial medium based on white peat, vermicompost and 1:1 mixture) used for sowing (52 mL volume per plant). The Se biofortification was made 40 days after sowing by application 15 mL of 40 μM Na_2SeO_4 solution into growth medium. The growth medium affected yield and the highest yield was achieved using commercial medium or 1:1 mixture with vermicompost, but simple vermicompost resulted in singificantly lower yield. The biofortification did not affected yield. The effect of medium and biofortification on Se concentration was just opposite since there was no significant effect of medium, but Se application in medium resulted in 173 times higher Se concentration in leaf of lamb's letucce than in control plants (1123.6 vs. 6.5 μg Se kg^{-1} FW). The results prove high potential of biofortification since for the recommended daily intake of Se (55 μg), it would be enough to consume 48.9 g of fresh biofortified lamb's lettuce compared to 8461.5 g nonbiofortified lamb's lettuce.

Key words: malnutrition, selenium, lamb's lettuce, vermicompost, agronomic biofortification

Bioraznolikost i simbiozna učinkovitost kvržičnih bakterija koje noduliraju grah

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Sažetak

Glavni cilj ovog istraživanja bio je utvrditi genotipske, fenotipske i simbiozne značajke autohtonih sojeva kvržičnih bakterija izoliranih iz 27 uzoraka tla sakupljenih na području sjeverozapadne Hrvatske.

Identifikacija je izvršena pomoću metode MALDI-TOF MS, RAPD-PCR i filogenetske analize *rrs*, *recA*, *atpD* i n*odC* gena. Fenotipska karakterizacija uključila je testiranje otpornosti na visoke koncentracije NaCl-a, različitih vrijednosti pH i temperatura, otpornost na antibiotike i iskorištavanje različitih izvora ugljika. U cilju utvrđivanja simbioznih svojstava odabranih 15 sojeva te njihove kompatibilnosti sa dvije tradicijske sorte graha postavljen je vegetacijski pokus u stakleniku.

Rezultati identifikacije pokuzuju da većina sojeva iz ovog istraživanja pripada vrstama *R. leguminosarum* i *R. hidalgonense*, koja je nedavno otkrivena u Americi. Dva soja su identificirana kao *R. pisi* dok nekoliko sojeva predstavlja potencijalnu novu vrstu. U vegetacijskom pokusu, najučinkovitija su bila dva soja (23T i 16T) koja pripadaju vrsti *R.leguminosarum*. Osim što su bili visoko učinkoviti u fiksaciji dušika, sojevi 1AT i 2Z (*R. leguminosarum*) pokazali su značajnu otpornost na nepovoljne uvjete kao što su visoke koncentracije NaCl i visoke temperature. Stoga bi ove sojeve trebalo uključiti u buduća istraživanja s ciljem odabira visokokvalitetnih sojeva za primjenu u održivoj proizvodnji graha.

Ključne riječi: simbiozna fiksacija dušika, autohtoni sojevi, *Rhizobium*, grah

Biodiversity and symbiotic efficiency of common bean rhizobia

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Abstract

The main aim of the present study was to assess genotypic, phenotypic and symbiotic features of indigenous common bean rhizobia isolated from 27 soil samples collected from the Northwestern Croatia.

Identification was performed by MALDI-TOF MS, RAPD fingerprinting and phylogenetic analysis of *rrs*, *recA*, *atpD* and n*odC* genes. Phenotypic characterization included testing the tolerance to high NaCl levels, different pH and temperatures values, intristic antibiotic resistance and assimilation of different carbon sources. Greenhouse experiment was setup in order to access symbiotic features of 15 chosen strains and their compatibility with two traditional bean varieties.

The results of identification show that most of strains isolated in this study belong to the species *R. leguminosarum* and *R. hidalgonense*, a species recently described in America. Two strains were identified as *R. pisi* and several strains represent a potential new species.

In greenhouse experiment, the most efficient were two strains (23T and 16T) belonging to *R.leguminosarum* species. Besides being highly efficient in symbiotic nitrogen fixation, strains 1AT and 2Z (*R. leguminosarum*) showed significant tolerance to unfavourable conditions such as high NaCl concentrations and high temperatures. Therefore, these strains should be included in further investigation in order to select high quality strain for application as biofertilizer for sustainable bean production.

Key words: symbiotic nitogen fixation, indigenous strains *Rhizobium*, common bean

Diferencijalna poroznost eutrično smeđeg i pseudoglejnog tla

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Sažetak

Tlo je polifazno i polidisperzno prirodno tijelo koje se sastoji od mineralne tvari i organske komponente (kruta faza), te šupljika odnosno pora u kojima se nalazi voda (tekuća faza) ili zrak (plinovita faza). Ukupni porozitet tla pokazuje samo ukupnu količinu pora u tlu, ali ne pokazuje njihov međuodnos. Međuodnos pora s vodom (kapilarnih) i pora sa zrakom (nekapilarnih) se naziva diferencijalna poroznost, a vrlo je važna za vodozračne odnose i plodnost tla. Ekološki povoljna diferencijalna poroznost je 3:2 u korist kapilarnih pora. U istraživanju je određivana diferencijalna poroznost eutričnog smeđeg (poljoprivredno tlo) i pseudoglejnog tla (šumsko tlo) zapadno Panonske poljoprivredne podregije pomoću pF aparata (tlačnog ekstraktora, tlačne membrane i kutije s pijeskom), kao i mehanički sastav tla svih horizonata u pet ponavljanja. Mehanički sastav eutrično smeđeg tla je praškasta ilovača cijelom dubinom solumu sa zastupljenošću brzodrenirajućih makropora od 3,6 do 5,0 % vol. i sporodrenirajućih makropora 3,5 do 3,9 % vol., zastupljenost srednjih mikropora ili pokretne kapilarne vode iznosi 31,1 do 33,8 % vol., dok je zastupljenost sitnih mikropora ili nepokretne kapilarne vode 12,8 do 19,6 % vol. Pseudoglejno tlo ima praškastu do praškasto-ilovastu teksturu sa zastupljenošću brzo drenirajućih makropora od 2,0 do 10,1 % vol. i sporo drenirajućih makropora 1,9 do 5,4 % vol., zastupljenost srednjih mikropora je od 34,3 do 39,9 % vol. i sitnih mikropora 15,8 do 24,6 % vol.. Rezultati istraživanja ukazuju da eutrično smeđe tlo ima povoljniju diferencijalnu poroznost u odnosu na pseudoglejno tlo.

Ključne riječi: tlo, diferencijalna poroznost, pF aparati, kutija s pijeskom

Differential porosity of eutric cambisol and pseudogley soil

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Abstract

The soil is a polyphasic and polydisperse natural body that consists of mineral matter and an organic component (solid phase), as well as pores filled with water (liquid phase) or air (gas phase). Total soil porosity shows only the quantity of pores in the soil, but not their interrelationship. The interrelationship between pores with water (capillary) and pores with air (noncapillary) is called differential porosity. Ecologically favorable differential porosity ratio is 3:2 in favor of capillary pores. The study examined differential porosity of the eutric cambisol (agricultural soil) and pseudogley soil (forest soil) of western Pannonian agricultural subregion using a pF apparatus (pressure extractor and a membrane and a sandbox) as well as determined the mechanical composition in all horizons of soil in five repetitions. Mechanical composition of the eutric cambisol is silty clay soil in the whole solum with 3,6 to 5,0 % vol. of fast-draining macropores, 3,5 to 3,9 % vol. of slow-draining macropores, 31,1 to 33,8 % vol. of medium micropores (mobile capillary water) and 12,8 to 19,6 % vol. of small micropores (immovable capillary water). The pseudogley soil has silty to silty clay texture with 2,0 to 10,1 % vol. of fast-draining macropores, 1,9 to 5,4 % vol. of slow-draining macropores, 34,3 to 39,9 % vol. of medium micropores and 15,8 to 24,6 % vol. of small micropores. The results suggest that eutric cambisol has a favorable differential porosity in relation to the pseudogley soil.

Key words: soil, differential porosity, pF apparatus, sandbox

Application of biopolymer microcapsules/ microspheres loaded with *Trichoderma viride* and calcium/copper ions during a hydroponic cultivation of lettuce

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Abstract

Encapsulation of bioactive agents such as fungi and agrochemicals is a promising way for nutrients delivery for a sustainable and safe plant production. Encapsulation of bioactive agents can slow and control the release of active compounds, therefore more efficient use of agrochemicals with better safety and environmental protection.

Trichoderma viride has shown the ability to enhance plant growth and its productivity. The dual roles of antagonistic activity against plant pathogens and promotion of soil fertility make *Trichoderma* species as a promising alternative to standard plant protection and nutrition technologies. Based on our previous research, microparticles containing different combinations of Ca^{2+}or Cu^{2+} ions, *T. viride*, alginate, and additional chitosan coating were optimized and applied in the hydroponic cultivation of lettuce (*Lactuca sativa* L.). Obtained ethanolic extracts of fresh lettuce were analyzed in terms of biologically active compounds. Compared to the control, results revealed a positive influence of microparticles on obtained biomass yield, rosette diameter, and height of lettuce as well as the significant impact on bioactive compounds content and antioxidant activity of ethanolic lettuce extracts.

Encapsulation of biological and chemical agents in biopolymeric microparticles has shown to be a sustainable, environmentally friendly, rapid, convenient, economical and efficient delivery of active agents for plant nutrition.

Key words: encapsulation, hydroponics, chemical agents, *Trichoderma viride*, microcapsules/ microspheres

Očuvanje biološke raznolikosti, ekoloških funkcija i općekorisnih vrijednosti travnjaka Parka prirode Medvednica

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Sažetak

Travnjaci se prostiru uglavnom rubnim dijelovima Parka prirode Medvednica gdje u dodiru s vegetacijom šumskih rubova i šikara formiraju brojne ekotone. Iako prekrivaju površinu Parka od samo 1,81%, značajno doprinose krajobraznoj raznolikosti područja, a važni su kao stanište brojnih vrsta bitnih za zaštitu. Cilj prvotnog istraživanja bio je utvrditi tipove travnjaka i stupanj njihova obrašćivanja unutar Parka. Istraživanje je provedeno 2010. godine na ukupno 49 lokaliteta a uključivalo je izradu vegetacijskih snimki standardnom Braun-Blanquet metodom te podatke o ekspoziciji, nagibu i načinu iskorištavanja staništa. Rezultati su utvrdili četiri osnovne grupe travnjaka i tzv. visokih zeleni, a unutar svake grupe mogu se razlikovati po dvije zajednice i nekoliko njihovih sukcesijskih stadija. Napuštanjem sela i tradicionalnog korištenja prostora poput ispaše i košnje, započeo je razvoj sukcesijske vegetacije drvenastih i grmolikih vrsta čime dolazi do promjene staništa. Kao najvredniji i najugroženiji pokazao se tip termofilnih suhih travnjaka s uspravnim ovsikom na širem području Čučerja koji predstavlja jedino preostalo nalazište vrste *Anemone sylvestris* u Hrvatskoj. Zbog svega navedenoga, djelatnici Javne ustanove zadnjih nekoliko godina redovito obilaze i procjenjuju stanje flore i travnjačkih staništa. Nastavak istraživanja i uvođenje monitoringa flore i ostalih sastavnica neophodno je za učinkovito planiranje upravljanja travnjacima i uvođenje mjera aktivnog gospodarenja.

Ključne riječi: travnjaci, flora, ruralni razvoj, sukcesija, upravljanje

Conservation of biodiversity, ecological functions and general values of Medvednica Nature Park´s grasslands

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Abstract

Grasslands stretch mainly along the edge parts of Medvednica Nature Park, where numerous ecotones are formed in contact with forest edges and shrubs vegetation. Although covering only 1.81% of the Park's surface, they contribute significantly to the landscape diversity and are important as habitats of many species that are relevant for protection. The aim of the first research was to determine the grassland types and their degree of overgrown within the Park. The survey was carried out in 2010 on a total of 49 localities, including the vegetation images production using the standard Braun-Blanquet method, as well as data on exposure, incline and habitat utilization. The results identified four basic grassland groups and so-called high green, and within each group two communities and several of their succession stages can be distinguished. By abandoning the villages and traditional use of space such as grazing and mowing, the development of successive vegetation of woody and bushy species has begun to change habitats. The most valuable and most endangered is the thermophilic dry grassland type with upright bromegrass in the wider Čučerje area as the only remaining finding site of *Anemone sylvestris* species in Croatia. Because all of this, the employees of the Public Institution have regularly visited and evaluated the condition of flora and grassland habitats in recent years. Further research and introduction of flora and other components monitoring is essential for effective grassland management planning and the introduction of active management measures.

Key words: grasslands, flora, rural development, succession, management

Konsocijacija drvenastih vrsta i poljoprivrednih kultura kao inovativni pristup u agroekosustavima

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Sažetak

Konsocijacija podrazumijeva uzgoj više kultura na istoj površini u isto vrijeme. Kombiniranjem trajnih nasada drvenastih kultura s poljoprivrednim kulturama na jednoj proizvodnoj površini direktno utječemo na temperaturu, vlagu, insolaciju te strujanje vjetra unutar nasada (mikroklimu) što za posljedicu ima veću otpornost biljaka na stresne uvijete kao što su klimatski ekstremi (suša, poplava). Cilj istraživanja je ispitati utjecaj međuodnosa oraha i poljoprivrednih kultura na prinose poljoprivrednih kultura unutar nasada. Pokus će biti proveden kroz pet godina, na dva lokaliteta od kojih će se svaki sastojati od tri parcele s istim tipom tla i sa ujednačenom gnojidbom na sve tri parcele na kojima se provodi ekološka poljoprivreda – kontrolna parcela sa usijanim poljoprivrednim kulturama bez oraha, parcela s nasadom oraha gdje će između redova biti usijane poljoprivredne kulture te trajni nasad oraha bez ratarskih kultura. U prvoj godini (2017/2018) usijana je pšenica. Na kontrolnoj parceli prinos pšenice je bio 6.7 t/ha dok je prinos pšenice usijane u orahe bio 6.0 t/ha, dakle za 11% niži. No s obzirom da je na parceli s orasima samo 75% površine bilo usijano (25% površine su zauzimali orasi), možemo reći da je prinos po ha još i niži, tj. 4.5 t/ha. Dakako ne smijemo zaboraviti na prinos oraha koji je bio jednak kao i u nasadu oraha bez pšenice tako da možemo reći da je 4.5 t/ha pšenice samo dodatni prinos tj. dodatni izvor zarade. Neophodna je provesti daljnju ekonomsku analizu kako bi se utvrdila isplativost ovakvih agroekosustava.

Ključne riječi: agrošumarstvo, orah, prinos, pšenica, međuredna proizvodnja

Intercropping of wood species and agricultural crops as an innovative approach in agroecosystems

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Abstract

Intercropping involves combining more plant species on the same parcel of land at the same time. The main benefits of the intercropping are: better use of the production area, positive influence on soil fertility, diversity of production in one vegetation, protection against plant disease, pests and weeds, better use of nutrients and water in soil as well as increased biodiversity. The aim of the research is to investigate the crop yields in such intercropped systems. The field trial will be conducted during five years, at two locations in two Counties, each field trial will consist of three parcels - control plot of agricultural crops without walnuts, walnut orchards with intercropped agricultural crops and a permanent walnut orchard without intercropped agricultural crops. Crop specie in the first year (2017/2018) was wheat. On the control plot the wheat yield was 6.7 t/ha, intercropped with the walnuts the wheat yield was 6.0 t / ha, which is 11% lower than control. However, given that only 75% of the intercropped area was covered with wheat (25% of the area occupied the walnuts), we can say that yield is even lower, i.e. 4.5 t/ha. However, the intercropped area in addition to wheat yield also has walnut yield which was the same as in walnut orchard without wheat. Therefore, wheat yield is an additional source of profit. It is necessary to carry out further economic analysis to determine the viability of such agroecosystems.

Key words: agroforestry, intercropping, yield, walnut, wheat

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Session 2

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Agricultural Economics and Rural Sociology

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Zbornik sažetaka

Agroekonomika i agrosociologija

Socio-demografska obilježja turista u kontekstu potrošnje i mjesta kupnje maslinova ulja

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Sažetak

Cilj rada je istražiti povezanost konzumacije, navike i mjesta kupnje maslinova ulja i socio-demografskih obilježja turista tijekom boravka u Hrvatskoj.

Istraživanje je provedeno od srpnja do rujna 2018. godine, upitnici su prikupljeni na uzorku turista (N=421) tijekom boravka na sjevernom Jadranu. Podaci su obrađeni distribucijom, frekvencijom i hi-kvadrat testom. Utvrđeno je da većina (82,7%) turista koji dolaze iz zemalja proizvođača maslinova ulja (Italija, Slovenija) troše maslinovo ulje svakodnevno, dok turisti iz zemalja ne proizvođača (Njemačka, Austrija, Belgija, Nizozemska) najčešće (44,4%) troše maslinovo ulje nekoliko puta tjedno. U daljnju obradu podataka uzeti su odgovori ispitanika koji kupuju maslinovo ulje tijekom boravka u Hrvatskoj (N=241). Maslinovo ulje znatno češće (88,2%) kupuju u destinaciji turisti koji dolaze iz zemalja ne proizvođača maslinova ulja. Na mjesto kupnje maslinovog ulja u destinaciji utječe status zaposlenosti ispitanika, pri čemu samozaposleni i zaposleni najčešće izabiru supermarkete. Na obiteljskim gospodarstvima kupuju najčešće turisti sa fakultetskim (32,8%) i višim obrazovanjem (29,7%). Ostale varijable ispitanika nisu signifikantne prema mjestu kupnje maslinova ulja. U cilju unaprjeđenja plasmana maslinovog ulja na Hrvatskom turističkom tržištu posebnu pažnju treba posvetiti turistima iz zemalja ne proizvođača maslinovog ulja.

Ključne riječi: maslinovo ulje, turisti, potrošnja, socio – demografska obilježja

The socio-demographic characteristic of tourists in context of consumption and purchase place of olive oil

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Abstract

The aim of the paper is to investigate the connection between consumption, habit and place of olive oil purchase by tourists during their stay in Croatia. The survey was conducted from July to September 2018. Data was collected through a structured questionnaire which was filled in by tourists (N=421) during their vacation on the north Adriatic coast. The data processing included distribution, frequency and hi-square test. Most of the tourists who (82.7%) are coming from olive oil producers countries (Italy, Slovenia) consume olive oil on a daily basis, while tourists from non-producers countries (Germany, Austria, Belgium, Netherlands) use olive oil (44.4%) several times a week. In the further processing of the data, was taken the answers from the respondents who indicated that they purchased olive oil during their stay in Croatia (N = 241). Tourists (88.2%) who are coming from non-olive oil producers' countries mostly buy olive oil during their stay in Croatia. The place of purchase of olive oil is influenced by the employment status of the respondents, self-employed and employed respondents most often choose supermarket. According to the education level tourists who finished university (32.8%) and higher education (29.7%) most frequently buy olive oil on the family farms. Other variables of the respondents are not significant regard to place of purchase of olive oil, during their stay in Croatia. In order to improve the placement of olive oil on the Croatian tourist market, special attention should be paid to tourists from non-olive oil producers.

Keywords: olive oil, tourists, consumption, socio - demographic characteristics

Organoleptička svojstva jabuka iz perspektive potrošača

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Sažetak

Jabuka je najzastupljenija voćna vrsta u našoj prehrani. Pri uzgoju jabuka važno je uzeti u obzir sklonosti potrošača, njihovih motiva i navika konzumacije. Ponuda jabuka u Hrvatskoj nije ujednačena, te se razlikuje kvalitetom, cijenom, načinom izlaganja i asortimanom. Sortiment ponuđenih jabuka na hrvatskom tržištu ne odgovara preferencijama domaćih potrošača. Prevladava Idared i Golden Delicious, dok su modernije sorte (Gala, Fuji, Braeburn, Pink Lady, Granny Smith) slabije dostupne i zastupljene, iako potražnja za njima i na domaćem, a pogotovo na inozemnom tržištu postoji. Cilj rada bio je na temelju senzorskog ispitivanja na uzorku od 100 potrošača istražiti jesu li prevladavajuće sorte jabuka u Hrvatskoj (Idared i Zlatni delišes) sorte koje potrošači ocjenjuju kao najkvalitetnije, ili su to modernije sorte (Gala, Fuji i Braeburn). Potrošači su organoleptička svojstva ocjenjivali na hedonističkoj skali od 1 do 9. Na temelju organoleptičkog ispitivanja jabuke i statističke obrade podataka možemo zaključiti da je za vizualni izgled za tri svojstva (oblik, krupnoća, ukupan vizualni izgled) najviše ocjene dobila sorta Zlatni delišes, a za dva svojstva (boja ploda, boja mesa) sorta Braeburn. Ispitanici sortu Braeburn ocjenjuju kao sortu najintenzivnijeg mirisa, teksture (gustoća, tekstura, hrskavost, sočnost, čvrstoća, čvrstoća kožice, ugoda žvakanja), okusa (intenzitet okusa, aromu, tipičnost, kiselost/šećer) i općeg dojma. Daljnji razvoj ovog sektora ovisit će o primjeni suvremenih metoda proizvodnje, udruživanju i educiranju proizvođača, ali i prilagodbi potrošačkih preferencija i marketingu.

Ključne riječi: jabuka, sortiment, organoleptička svojstva, potrošači, preferencije

Organoleptic characteristics of apples from a consumer perspective

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Abstract

Apple is the most comon fruit species in our diet. When growing apples, it is important to take into account consumer preferences, their motivations and habits of consumption. The apple supply is not continual and differs in quality, price, presentation and assortment. The variety of apples offered on the Croatian market does not match the preferences of domestic consumers. The Idared and Golden Delicious are dominated, while the more modern varieties (Gala, Fuji, Braeburn, Pink Lady, Granny Smith) are less widely available and represented, although there is a demand for them both domestically and on the foreign market. The aim of the paper was to investigate according to sensory test on a sample of 100 consumers whether the predominant apple cultivars in Croatia (Idared and Golden Delis) are the ones that consumers consider to be the best in quality or these are more modern varieties (Gala, Fuji and Braeburn). Consumers evaluated the organoleptic properties on the hedonistic scale from 1 to 9. On the basis of the organoleptic examination of apples, we can conclude that the best evaluted variety of the three visual features (shape, size, color, color of meat, total visual appearance) is Golden Delicious, and in two properties (color of fruit, color of meat) the Braeburn variety is tbe best evaluated. Braeburn was rated as the variety of the most intense smell, texture (density, texture, crustiness, tenderness, firmness, skin firmness, chewing pleasure), taste (flavor intensity, aroma, typicality, acidity / sugar) and the general impression. Further development of this sector will depend on the application of modern production methods, the association and education of producers as well as adjustment of consumer preferences and marketing.

Key words: apple, varieties, organoleptic properties, consumers, preferences

Ocjena ekološke održivosti konvencionalnih poljoprivrednika u Istri

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Sažetak

Cilj rada je ocijeniti stupanj ekološke održivosti proizvodnje te istražiti povezanost socio-ekonomskih obilježja gospodarstava na njihovo opredjeljenje za konvencionalni ili integrirani sustav proizvodnje. Istraživanje je provedeno u 2017. godini metodom osobnog i on line anketiranja 154 poljoprivredna gospodarstva u Istri. Podaci su obrađeni u SPSS softveru v21, jednovarijantnom i dvovarijantnom analizom. Sustavom integrirane proizvodnje se bavi 52,6% gospodarstava. Integrirani oblik proizvodnje je relativno zastupljeniji kod gospodarstava čiji su nositelji u dobi od 41-70 godina (54,6%), ženskog spola (61,5%) te imaju završeno više ili visoko obrazovanje (57,1%). Utvrđena je statistički značajna povezanost između opredjeljenja za integriranu poljoprivredu i činjenice da barem jedan član gospodarstva ima poljoprivredno obrazovanje pri čemu se za takav sustav češće opredjeljuju gospodarstva bez poljoprivredne naobrazbe (72,8%). Integriranom poljoprivredom se češće bave kućanstva koja od poljoprivrede ostvaruju manji udio svog ukupnog dohotka. Indeks održivosti integriranih proizvođača signifikantno je veći od indeksa održivosti konvencionalnih proizvođača. Međutim, grupiranjem vrijednosti indeksa, oba sustava spadaju u grupu „niska održivost". Utvrđena je signifikantna povezanost između sustava proizvodnje i stupnja održivosti te obrazovanja i stupnja održivosti. Kako bi se postigao viši stupanj ekološke održivosti poljoprivredne proizvodnje potrebno je usvajanje agroekoloških praksi.

Ključne riječi: ekološka održivost, konvencionalna poljoprivreda, integrirana poljoprivreda

Assessment of ecological sustainability of conventional farmers in Istria

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Abstract

The aim of the study was to assess the degree of ecological sustainability of farms and to investigate the socio-economic impact of farms on their decision to grow in the conventional or integrated production system. The survey was conducted in 2017 by direct and online interviewing 154 households in Istria. The data were analyzed using SPSS software v21, descriptive statistics and test of independence. The integrated production system is practiced by 52.6% farms. The system is relatively more represented by farmers being 41-70 age old (54.6%), female (61.5%) and with higher levels of education (57.1%). There is a statistically significant association between the choice of practicing integrated farming and the fact that at least one of the farm members has an agricultural education, whereby the integrated farming is more often practiced by farmers without any agricultural education (72.8%). Integrated farming is commonly practiced by households whose share of farm income is small in the total household income. Sustainability index of integrated farms is significantly higher than of the conventional farms. However, by grouping index values, both systems fall into the "low sustainability" group. Significant associations were found between production systems (integrated and conventional) and the degree of sustainability, and the education level and the degree of sustainability. In order to achieve a higher degree of ecological sustainability in agricultural production, it is necessary to apply agroecological practices.

Key words: ecological sustainability, conventional agriculture, integrated agriculture

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Genetics, Plant Breeding and Seed Production

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Zbornik sažetaka

Genetika, oplemenjivanje bilja i sjemenarstvo

Sadržaj ukupnih topljivih šećera u kultivarima ječma tijekom razvoja

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Sažetak

Biljke su tijekom rasta i razvoja često izložene različitim stresnim čimbenicima. Budući da je ječam jedna od glavnih žitarica koja se koristi u ljudskoj i životinjskoj ishrani nužno je razumjeti strategije prilagodbe na stres i kreirati tolerantne kultivare. Cilj ovog istraživanja bio je odrediti sadržaj ukupnih topljivih šećera (TSS) u listovima dvadeset kultivara ozimog ječma tijekom razvoja u varijabilnim vremenskim uvjetima. Kultivari su rasli na eksperimentalnim poljima Poljoprivrednog instituta Osijek. Uzorkovanja su izvršena tijekom tri fenološke faze. Prosječne vrijednosti TSS izmjerene tijekom vlatanja, cvatnje i nalijevanja zrna su iznosile 37,18, 43,44 i 46,17 mg g^{-1} suhe tvari. Porast količine izmjerenih šećera može se povezati sa blagom sušom koja je zabilježena tijekom cvatnje i nalijevanja zrna. U istraživanim kultivarima zabilježena je različita akumulacija šećera. U pet kultivara ('Zlatko', 'Casanova', 'Maxim', Osk.5.87/1-13 i 'Lord') sadržaj šećera nije se mijenjao tijekom razvoja. U dva kultivara ('Barun' i 'Bravo') akumulacija ukupnih šećera započela je u fazi nalijevanja zrna, dok je u ostalima akumulacija šećera zabilježena već tijekom cvatnje. Rezultati ovog istraživanja ukazuju na prisutnost različitih mehanizama prilagodbe na blagu sušu. Brojna dosadašnja istraživanja također su pokazala osjetljivost TSS na stres izazvan sušom. Nadalje, razlike u sadržaju ukupnih topljivih šećera mogle bi se koristiti tijekom selekcije kultivara tolerantnih na sušu.

Ključne riječi: *Hordeum vulgare*, ukupni topljivi šećeri, suša, razvojne faze

Changes of total soluble sugars content in barley cultivars during the growth

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Abstract

Throughout the entire growth and development, plants are often exposed to various environmental stressors. Since barley is one of the main cereals used for human and animal nutrition, it is necessary to understand adaptive strategies and develop stress tolerant cultivars. The aim of this study was to screen and evaluate twenty winter barley cultivars for their total soluble sugars (TSS) content in leaves during the growth cycle in variable weather conditions. Samplings from the experimental fields at Agricultural Institute Osijek were performed at three phenological stages. The average values of TSS measured in tested cultivars in booting, flowering and grain filling stage were 37.18, 43.44, and 46.17 mg g^{-1} dry weight. The increase of TSS content could be associated with mild drought stress, recorded at flowering and grain filling stages. Different accumulation pattern was observed in tested cultivars. No changes in accumulation of TSS in five varieties during the growth ('Zlatko', 'Casanova', 'Maxim', Osk.5.87/1-13 and 'Lord') were observed. Two cultivars ('Barun' and 'Bravo') accumulated TSS at the grain filling stage while the others showed accumulation at the flowering stage. These results might indicate the occurrence of different adaptive strategies to avoid mild drought. Numerous recent studies also showed high sensitivity of TSS to drought stress. Furthermore, the differences in the TSS content among cultivars could be used as a suitable selection indicator for drought tolerance.

Key words: *Hordeum vulgare*, total soluble sugars, drought stress, developmental stages

Nakupljanje lignina i celuloze u različitim kultivarima ozimog ječma

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Sažetak

Sadržaj lignina i celuloze ovisi o brojnim čimbenicima uključujući genotip, razvojnu fazu te čimbenike u okolišu. U ovom radu istraživane su promjene sadržaja lignina i celuloze u deset kultivara ozimog ječma (*Hordeum vulgare* L.) oplemenjivačkog programa Poljoprivrednog instituta Osijek tijekom jedne razvojne sezone. Biljni materijal, koji je uključivao stabljiku, uzorkovan je u tri razvojne faze: vlatanje, cvatnja i nalijevanje zrna. U fazi vlatanja najmanji sadržaj lignina izmjeren je u kultivaru 'Osk5.36/25-15' i iznosio je 36 mg g^{-1}, a najveći sadržaj, 150 mg g^{-1} suhe tvari (s.t), izmjeren je u kultivaru 'Osk.4.36/9-14'. Sadržaj celuloze kretao se od najmanje 41 % u kultivaru 'Osk.4.37/14-14', do 59 % s.t. u kultivaru 'Panonac'. U fazi cvatnje sadržaj ukupnog lignina i celuloze varirao je među kultivarima u odnosu na vlatanje. U pojedinim kultivarima došlo je do smanjenja sadržaja lignina i celuloze. U fazi nalijevanja zrna sadržaj lignina i celuloze porastao je u odnosu na cvatnju. Najveći sadržaj lignina iznosio je 157 mg g^{-1} kod kultivara 'Osk.4.37/14-14', a najmanji 133 mg g^{-1} s.t. kod kultivara 'Osk.5.36/25-15', dok je sadržaj celuloze varirao od najmanje 36 % do najviše 52 % s.t. kod svih kultivara. Smanjenje ukupnog sadržaja lignina u cvatnji može se pripisati pojavi blage suše. Porast lignina u fazi nalijevanja zrna posljedica je razvojnih procesa vezanih za lignifikaciju stabljike, ali može također predstavljati i mehanizam adaptacije pojedinih kultivara na uvjete blagog stresa.

Ključne riječi: *Hordeum vulgare*, lignin, celuloza, razvoj, klimatske promjene

Accumulation of lignin and cellulose in different winter barley cultivars

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Abstract

Lignin and cellulose content depends on several factors including genotype, developmental phase and environmental conditions. This paper investigates the changes of lignin and cellulose content in ten winter barley (*Hordeum vulgare* L.) cultivars from Agricultural Institute Osijek breeding program during one growing season. Plant material, which included stem, was sampled at three developmental phases: booting, flowering and grain filling. At booting, the lowest lignin content was measured in cultivar 'Osk5.36/ 25-15' (36 mg g^{-1} dry matter, DM) and the highest content in cultivar 'Osk.4.36/9-14' (150 mg g^{-1} dry matter). Cellulose content ranged from 41% in the 'Osk.4.37/14-14' and up to 59% DM in 'Panonac'. At flowering total lignin content and cellulose varied among the cultivars in comparison to the booting. In some cultivars, lignin and cellulose content decreased. At grain filling lignin and cellulose content, increased compared to the flowering. The highest lignin content was 157 mg g^{-1} in cultivar 'Osk.4.37/14-14', and the lowest was 133 mg g^{-1} DM in 'Osk.5.36/25-15', while the cellulose content varied from 36% to 52% DM considering all cultivars. Decrease of total lignin content at flowering can be attributed to the appearance of mild drought. Increase of lignin content at grain filling stage is the consequence of developmental processes related to the stem lignification but may also be adaptation mechanism of certain cultivars to mild stress conditions.

Key words: *Hordeum vulgare*, lignin, cellulose, development, climate change

Nakupljanje i remobilizacije fruktana tijekom razvoja odabranih kultivara ozimog ječma

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Sažetak

Fruktani u biljkama predstavljaju rezervne ugljikohidrate koji se skladište u stabljici, lukovici i korijenu, a imaju važnu ulogu u zaštiti biljke u stresnim uvjetima. U žitaricama, kao što je ječam (*Hordeum vulgare* L.), fruktani se tijekom razvoja pohranjuju u stabljici i poslije cvatnje se mobiliziraju u zrno te mogu značajno utjecati na prinos u normalnim, a posebno u stresnim uvjetima. Cilj ovog istraživanja bio je istražiti sadržaj fruktana u stabljici 15 odabranih kultivara ozimog ječma iz oplemenjivačkog programa Poljoprivrednog instituta Osijek. Uzorci su prikupljeni u tri razvojne faze: vlatanje, cvatnja i nalijevanje zrna. Uočene su značajne varijacije sadržaja fruktana u pojedinom kultivaru. Budući da nakupljane fruktana počinje u fazi cvatnje, tako je i ovdje zamijećen značajni porast kod 14 kultivara, u odnosu na fazu vlatanja, osim kod kultivara Osk.4.37/14-14. Značajni porast sadržaja fruktana, u odnosu na cvatnju, uočen je kod sedam kultivara u fazi nalijevanja zrna, a najveći porast je kod kultivara Osk.5.36/25-15 (187 μg g^{-1} suhe tvari, s.t.), 'Panonac' (121 μg g^{-1} s.t.), 'Titan' (177 μg g^{-1} s.t.) te 'Osvit' (138 μg g^{-1} s.t.) u odnosu na cvatnju gdje je zabilježena prosječna vrijednost sadržaja fruktana ova četiri kultivara od 53 μg g^{-1} s.t. Budući da je došlo do pojave blage suše u fazi cvatnje koja se zadržala i u fazi nalijevanja zrna, ovakav značajni porast sadržaja fruktana ukazuje na potencijalnu osjetljivost pojedinih kultivara na stresne uvjete.

Ključne riječi: *Hordeum vulgare*, fruktani, ugljikohidrati, razvoj, stres

Fructan accumulation and remobilization in selected winter barley cultivars during development

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Abstract

Within plants, fructans represent reserve carbohydrates that are stored in stems, bulbs and roots. They play an important role protecting the plant in stressful conditions. In cereals, such as barley (*Hordeum vulgare* L.), fructans are stored in the stem during growth and after flowering they are mobilized into the grain. They have a significant effect on yield in normal and especially in stressful conditions. The aim of this study was to investigate the fructan content in the stem of selected winter barley cultivars from the breeding program of the Agricultural Institute Osijek. Samples were collected at three growth stages: booting, flowering and grain filling. Significant variations in fructan content were observed in each cultivar. Since fructan accumulation begins at flowering, there was significant increase in 14 cultivars compared booting, except in the cultivar Osk.4.37/14-14. Significant increase of fructan content, in comparison to flowering, was observed in seven cultivars at grain filling stage. The highest increase was observed in cultivars Osk.5.36/25-15 (187 μg g^{-1} dry matter, DM), 'Panonac' (121 μg g^{-1} DM), 'Titan' (177 μg g^{-1} DM) and 'Osvit' (138 μg g^{-1} DM) compared to flowering where the average fructan content of these four cultivars was 53 μg g^{-1} DM. Since the mild drought occurred during flowering stage and remained at grain filling stage, this significant increase in fructan content indicates the potential sensitivity of some varieties to stressful conditions.

Key words: *Hordeum vulgare*, fructans, carbohydrates, development, stress

Uspostavljanje kolekcije kultiviranog bilja u ZAGR Herbariju

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Sažetak

Cilj ovog rada je analizirati kolekciju kultiviranih biljaka koje se nalaze u ZAGR Herbariju. ZAGR je međunarodni akronim koji je dodijeljen Herbariju Agronomskog fakulteta Sveučilišta u Zagrebu pri osnivanju 2013. godine. Procjenjuje se da ZAGR Herbarij sadrži preko 7500 primjeraka vaskularnih biljaka. Od 2014. godine herbarijska građa koja je pohranjena u ZAGR Herbariju obuhvaća, pored samonikle vaskularne flore, također i kolekciju kultiviranih biljaka. Osobitu vrijednost u kolekciji čine kultivirane vrste koje su zastupljene sa sortama. Analizom je ustanovljeno da 148 herbarijskih primjeraka pripada kolekciji od 20 kultiviranih vrsta koje su zastupljene sa sortama. Najviše sorata, njih po 10, imaju maslina i vinova loza. Voćarske kulture poput jabuke, kruške, višnje, trešnje, breskve, oraha, borovnice, bijelog i crvenog ribiza, ogrozda i aronije također su zastupljene u ZAGR Herbariju, ali s manjim brojem sorata. Sa sortama su također zastupljene pšenica, ječam, grah, bosiljak, niska i visoka kadifica te facelija. Sorte kultiviranih biljaka sakupljene su uglavnom na pokušalištima Agronomskog fakulteta Sveučilišta u Zagrebu (Maksimir i Jazbina), na pokušalištu Hrvatskog centra za poljoprivredu, hranu i selo u Donjoj Zelini te na pokusnom imanju Instituta za poljoprivredu i turizam u Poreču. Kolekcija kultiviranih biljaka dostupna je na http://herbarium.agr.hr/. Navedeni rezultati ukazuju da ZAGR Herbarij pruža značajan izvor informacija o kultiviranim biljkama.

Ključne riječi: kolekcija kultiviranih biljaka, herbarij, ZAGR, Zagreb

Establishment of cultivated plant collection in ZAGR Herbarium

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Abstract

The aim of this paper is to analyse the collection of cultivated plants housed in ZAGR Herbarium. ZAGR is an international acronym that was awarded to the Herbarium of the Faculty of Agriculture, University of Zagreb in 2013 when it was founded. It is estimated that ZAGR Herbarium contains over 7500 specimens of vascular plants. Since 2014, in addition to autochthonous vascular flora, the herbarium material stored in ZAGR Herbarium also includes a collection of cultivated plants. Cultivated species represented by cultivars are of special value in the collection. An analysis showed that 148 herbarium specimens belong to the collection of 20 cultivated species represented by cultivars. Olive and grapevine have the most cultivars, that is 10 each. Fruit crops such as apple, pear, sour cherry, cherry, peach, walnut, blueberry, white and red currant, gooseberry and aronia are also represented in ZAGR Herbarium, but with a smaller number of cultivars. Wheat, barley, beans, basil, lacy phacelia, French marigold and Mexican marigold are also represented by cultivars. Cultivars were collected mostly at the experiment stations of the Faculty of Agriculture, University of Zagreb (Maksimir and Jazbina), at the experiment station of the Croatian Centre for Agriculture, Food and Rural Affairs in Donja Zelina and at the experimental estate of the Institute of Agriculture and Tourism in Poreč. The collection of cultivated plants is available at http://herbarium.agr.hr/. The above results indicate that ZAGR Herbarium provides a significant source of information on cultivated plants.

Key words: collection of cultivated plants, herbarium, ZAGR, Zagreb

Optimalna priprema sjemena za uzgoj pšenične trave (*Triticum aestivum* L.)

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Sažetak

Pšenična trava predstavlja mlade izdanke pšenice (*Triticum aestivum* L.) koji se zbog svoje visoke nutritivne vrijednosti koriste kao prirodni dodatak prehrani, najčešće u obliku svježeg soka. Pšenična trava za pripremu svježeg soka uglavnom se uzgaja u kućnom uzgoju, prilikom kojega je česta pojava plijesni, što takvu pšeničnu travu čini nepogodnom za konzumaciju.

Cilj istraživanja bio je ispitati razlike između načina dezinfekcije sjemena (destilirana voda, autoklavirana voda i 15 % NaClO) te vrste i načina dezinfekcije supstrata (bez supstrata, kvarcni pijesak i Brill supstrat (dezinficiran i nedezinficiran)) na pojavu plijesni, broj i masu biljaka, količinu soka te koncentraciju kloroplastnih pigmenata na dvije sorte pšenice ('Ilirija' i 'Katarina'). Za dezinfekciju sjemena i supstrata korištene su metode koje je moguće primijeniti u kućanstvu.

Neovisno o sorti i načinu dezinfekcije sjemena najveći razvoj plijesni te najniži broj i masa biljaka uočeni su na tretmanima uzgoja bez supstrata. U obje sorte, najveća masa biljaka izmjerena je kod biljaka kod kojih je sjeme bilo dezinficirano destiliranom vodom a uzgajano na dezinficiranom Brill supstratu (23.77 ± 1.07 g i 17.73 ± 0.40 g kod 'Ilirije', odnosno 'Katarine'). Masa biljaka i količina soka su u pozitivnoj vezi ($r = 0,98$; $p<0,01$). Dobiveni rezultati ukazuju da su ispitivana svojstva pod najvećim utjecajem sorte i vrste supstrata.

Ključne riječi: pšenična trava, klorofil, dezinfekcija sjemena

The optimal preparation of seeds for cultivation of wheatgrass (*Triticum aestivum* L.)

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Abstract

Young wheat shoots (*Triticum aestivum L.*) are known as wheatgrass. Wheatgrass is used as a natural food supplement most commonly in the form of fresh juice. A wheatgrass for preparation of juice is mainly grown in a housholds, where mildew occurrence often makes such wheatgrass unsuitable for consumption. The aim of this study was to investigate the differences in seed disinfection (distilled water, autoclaved water and 15% NaClO) and the substrate (without substrate, quartz sand and Brill substrate (disinfected and non-disinfected)) on the incidence of mildew, the number of plants, plant weight, amount of juice and the concentration of chloroplast pigments in two cultivars ('Ilirija' and 'Katarina'). Disinfection of seeds and substrates are carried out with methods that can be applied in the households.

The highest incidence of mildew, lowest number of plants and lowest plant weight were detected in the wheatgrass cultivated without substrate, regardless of cultivar and disinfection. The highest plant weight in both cultivars was obtained in plants grown from seeds disinfected with distilled water on the disinfected Brill substrate (23.77 ± 1.07 g and 17.73 ± 0.40 g in 'Ilirija' and 'Katarina', respectively). Plant weight and the amount of juice are correlated ($r = 0.98$, $p < 0.01$). The obtained results indicate that examined traits are under strongest effect of cultivar and type of substrate for plant growth.

Key words: wheatgrass, chlorophyll, disinfection of seeds

TaCwi-A1 i TaSus2-2B geni u hrvatskom sortimentu ozime pšenice

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Sažetak

Masa 1000 zrna je, uz broj fertilnih klasova po jedinici površine i broj zrna po klasu, jedna od glavnih komponenti prinosa pšenice. Saharozna sintetaza (SUS - Sucrose Synthase) je enzim koji ima ključnu ulogu u pretvorbi saharoze u škrob, a koji čini najveći dio suhe tvari zrna te tako direktno utječe na formiranje njegove mase. Invertaza stanične stijenke (CWI - Cell Wall Invertase) je još jedan enzim povezan s masom 1000 zrna, a koji katalizira hidrolizu saharoze do glukoze i fruktoze. Cilj ovoga istraživanja bio je ispitati alelnu kompoziciju TaCwi-A1 i TaSus2-2B lokusa na uzorku od 50 hrvatskih kultivara ozime pšenice. Prisutnost TaCwi-A1a alela utvrđena je kod 90 % ispitivanih kultivara pšenice, a TaCwi-A1b alela kod njih 14 %. Na TaSus2-2B lokusu utvrđena je prisutnost Hap-L haplotipa kod 80 % ispitivanih kultivara pšenice, dok je Hap-H haplotip utvrđen kod njih 6 %. Prosječna masa 1000 zrna kultivara s TaCwi-A1a alelom bila je 47,79 g, a onih s TaCwi-A1b alelom 48,35 g. Kultivari s haplotipom Hap-L imali su prosječnu masu 1000 zrna 47,81 g, a oni s Hap-H haplotipom 49,93 g. Nisu utvrđene značajnije razlike u masi 1000 zrna s obzirom na različite alelne kompozicije ispitivanih kultivara. To se može objasniti činjenicom da je masa 1000 zrna kompleksno svojstvo pod utjecajem većeg broja gena te nije moguće objasniti potpunu fenotipsku varijancu na osnovu alelne kompozicije samo dva lokusa.

Ključne riječi: pšenica, masa 1000 zrna, TaCwi-A1, TaSus2-2B

TaCwi-A1 and TaSus2-2B genes in Croatian winter wheat varieties

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Abstract

Thousand kernel weight (TKW), along with number of fertile spikes per unit area and number of grains per spike, is one of the main wheat yield components. Sucrose synthase (SUS) is an enzyme that has a key role in the conversion of sucrose to starch, which comprises the majority of the final dry weight of the grain. Cell wall invertase (CWI) is also an enzyme associated with thousand kernel weight, which catalyzes the hydrolysis of sucrose to glucose and fructose. The aim of this study was to examine the allelic composition of TaCwi-A1 and TaSus2-2B loci among 50 Croatian winter wheat varieties. The presence of TaCwi-A1a allele was determined in 90% of examined wheat varieties, and TaCwi-A1b allele in 14% of examined varieties. At TaSus2-2B locus, presence of Hap-L haplotype was determined in 80% of examined wheat varieties, while Hap-H haplotype was determined in 6% of examined varieties. The average TKW of wheat varieties with TaCwi-A1a allele was 47.79 g, and of those with TaCwi-A1b allele 48.35 g. Varieties with Hap-L haplotype had an average TKW of 47.81 g, and those with Hap-H haplotype TKW of 49.93 g. No significant differences in TKW were found regarding different allelic composition of examined varieties. This can be explained by the fact that TKW is a complex trait controlled by a large number of genes, so it is not possible to explain the complete phenotypic variance considering allelic composition of only two loci.

Key words: wheat, thousand kernel weight, TaCwi-A1, TaSus2-2B

Reakcija proteina pšenice na folijarnu gnojidbu ureom

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Sažetak

Stvaranje kultivara pšenice visoke rodnosti i visokog udjela proteina može biti vrlo zahtjevno jer su ova dva svojstva u obrnutoj korelaciji. Primjena folijarne gnojidbe ureom u kasnijim fazama rasta pšenice najučinkovitija je metoda povećanja proteina. Cilj rada bio je procijeniti utjecaj N gnojidbe na količinu i distribuciju proteina pšenice. U radu je analizirano 12 kultivara pšenice uzgojenih na Poljoprivrednom institutu Osijek tijekom vegetacijske sezone 2016./2017. uz primjenu standardne (115 kgN ha-1) i dodatne folijarne gnojidbe s 15 % ureom (12. svibnja 2017.). U cjelovitom zrnu ukupni proteini analizirani su na Infratec 1241 uređaju a proteinske frakcije RP-HPLC metodom. U prosjeku, dodatna folijarna gnojidba ureom povećala je udio proteina za 25,3 % (10,3 % standardna gnojidba i 12,9 % urea), dok je količina topljivih albumina i globulina porasla za 14,5 %, glijadina (GLI) za 33,2 % i glutenina (GLU) za 15,6 %. Reakcije kultivara na folijarnu gnojidbu su specifične. Najveće povećanje ukupnih proteina zabilježeno je kod kultivara 'Renata', 'Katarina', 'Felix' i 'Galloper'. Značajno povećenje ukupnih proteina rezultiralo je najvećim povećanjem GLU/GLU omjera uslijed povećane sinteze monomernih GLI nakon gnojidbe ureom.

Ključne riječi: pšenica, kultivari, N gnojidba, proteinske frakcije

Response of wheat proteins to foliar application of urea

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Abstract

Selecting wheat cultivars with *both high* yield and protein content may be difficult because these two properties are inversely correlating. Application of foliar N late in the season is the most efficient method of boosting grain protein. The aim of this study was to evaluate the impact of N fertilization on content and distribution of wheat proteins. Twelve wheat cultivars (*Triticum aestivum L.*) of the Agricultural Institute Osijek were grown during the season 2016/2017 at standard N fertilization (115 kgN ha^{-1}) and additional foliar fertilization with 15% urea (12 May, 2017). In whole grain protein content (P) was measured by NIT analyzer Infratec 1241, while protein fractons were determined with RP-HPLC method. On average, protein content under additional N supply was increased on average by 25.3% (10.3% standard fertilization vs. 12.9% urea), while soluble albumins and globulins increased by 14.5%, gliadins (GLI) and glutenins (GLU) by 33.2% and 15.6%, respectively. The response of cultivars to additional N fertilization is specific, so the largest increase in P had cultivars 'Renata', 'Katarina', 'Felix' and 'Galloper'. A significant increase in total protein resulted in the highest increase in GLI/GLU ratio due to the increased synthesis of monomeric GLI after fertilization with urea.

Key words: wheat, cultivars, N fertilization, protein fractions

Proportion of the medium large round seed fraction of maize inbred lines in dependence on the cytoplasm type

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Abstract

The aim of the present study was to determine the proportion of the medium large round seed fraction of the maize inbred lines depending on the cytoplasm type. The studies encompassed 12 inbred lines with different types of cytoplasm (*cms*-C, *cms*-S and fertile) that were tested in two locations (Selection Field and Školsko dobro) during 2015 and 2016. The three-replicate trials were set up according to randomised complete-block design within each type of cytoplasm. The analysis of variance indicated that the cytoplasm type was a decisive factor in the expression of the seed fraction - medium large round (MLR).. The highest, i.e. lowest value of this trait, on average, was recorded in the inbred line L_1 (47.9%), i.e. L_7 (1.4%), respectively. The average percent of the MLR seed fraction significantly varied (P≤5%) in respect of the observed cytoplasm type. The highest and the lowest values of this trait were established in sterile cytoplasm *cms*-C (13.8%), and fertile cytoplasm (12.8%), respectively. The medium values of the MLR seed fraction very significantly (P≤1%) varied in dependence on the year and location of investigation. The greater proportion of the MLR seed fraction was determined in maize inbred in 2015 (19.4%) than in 2016 (7.5%), as well as in the location of Selection Field (14.4%) than in Školsko dobro (12.5%). The analysis of obtained results point out to a significant effect of the cytoplasm type on the medium large round seed fraction.

Key words: cytoplasmic male sterility, inbred lines, seed fraction

Kakvoća najzastupljenijih sorti soje u Republici Hrvatskoj

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Sažetak

Sortiment soje u Republici Hrvatskoj čine domaće i strane sorte u kojemu je tržišni udjel domaćeg sortimenta zastupljen sa 61,0 %, a strani sa 39,0 %. Tijekom 2018. godine u Republici Hrvatskoj proizvedeno je i deklarirano 9208 t sjemena 42 različite sorte soje. Površine pod merkantilnom sojom u stalnom su porastu. U 2018. godini soja je posijana na ukupno 85.000 ha, a za očekivati je zadržavanje ili blagi rast površina u narednim godinama, prvenstveno zbog visoke i stabilne otkupne cijene. Pokus je postavljen 2018. po slučajnom bloknom rasporedu (RCBD) u dvije repeticije, na površinama Zavoda za sjemenarstvo i rasadničarstvo Hrvatskog centra za poljoprivredu, hranu i selo u Osijeku (N45°31', E18°40') uz primjenu standardne agrotehnike za soju. U pokus je uključeno 10 sorata koje su najzastupljenije u Republici Hrvatskoj, a koje zauzimaju 73,70 % ukupnih površina zasijanih sojom. Na temelju dobivenih podataka utvrđene su statistički opravdane razlike između sorata, za svojstvo sadržaja ulja i proteina. Najveći prosječni sadržaj ulja ostvarile su sorte 'Sonja' (22,01 %), 'Lucija' (21,90 %) i 'Tena' (21,88 %) te između njih nisu utvrđene značajne razlike. Sorte koje su imale najveći prosječni sadržaj proteina su 'Zlata' (43,00 %) i 'Merkur' (42,18 %) između kojih također nisu utvrđene statistički značajne razlike. Dobiveni rezultati pokazuju da između ispitivanih sorti postoje genetske različitosti koje su se manifestirale u godini ispitivanja.

Ključne riječi: soja, sorta, sadržaj ulja, sadržaj proteina

The quality of the most common soybeans variety in Republic of Croatia

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Abstract

The assortment of soybeans in the Republic of Croatia consists of domestic and foreign varieties, where market share of domestic varieties is 61,0% and foreign varieties 39,0%. During 2018, a total of 9.208 t of soybean seeds of 42 different varieties is produced and declared in the Republic of Croatia. Areas under mercantile soybeans are steadily increasing. In 2018, soybeans were planted on a total of 85.000 hectares, and it is expected to remain on that level or to grow slightly in the coming years, primarily due to high and stable purchase price. The experiment consisted of ten most representative varieties which occupy 73,70% of total areas under soybeans in the Republic of Croatia was set up in 2018 by a Randomized Complete Block Design method (RCBD) in two repetitions, at the Institute for Seeds and Seedlings, Croatian Center for Agriculture, Food and Rural Affairs in Osijek (N45°31', E18°40'), using standard agrotechnics for soybeans. Statistically significant differences between varieties were determined for the traits of oil content and protein content. The highest average oil yield achieved varieties 'Sonja' (22,01%), 'Lucija' (21,90%) and 'Tena' (21,88%), and there were no statistically significant differences among them. The varieties that had the highest average content of protein were 'Zlata' (43,00%) and 'Mercury' (42,18%) among which no statistically significant differences were found. The obtained results show that genetic differences among varieties included in the study exist, and were manifesting in the year of experimentation.

Key words: soybean, variety, oil content, protein content

Utjecaj tretmana plazme na genotipove ozime pšenice

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Sažetak

Jedna od mogućnosti povećanja prinosa zrna u uvjetima pod utjecajem abiotičkog stresa je poboljšanje klijavosti sjemena. Korištenje kemijskih metoda koje se često koriste za tu svrhu, zbog njihovog negativnog utjecaja na ljudsko zdravlje i okoliš, treba koristiti u što manjoj mjeri. Tretiranje sjemena plazmom je nova, fizikalna tehnologija u poljoprivrednoj praksi, koja može poboljšati klijavost sjemena i rast klijanaca. Plazma je četvrto agregatno stanje u kojem su čestice bez naboja. Plazma mijenja kemijska svojstva omotača zrna tako da zrno ima mogućnost dodatnog upijanja vode. U ovom istraživanju ispitat će se učinak tekuće plazme primjenom nekoliko različitih frekvencija tekuće plazme na genotipove ozime pšenice prije nego budu izloženi utjecaju suše. Učinak plazme pratit će se određivanjem brzine klijavosti tretiranog sjemena, određivanjem klijavosti (%), mjerenjem morfometrijskih parametara duljina izdanka i korijena tijekom nekoliko dana u kontrolnim uvjetima i uvjetima smanjene količine vode. Suša će se izazvati primjenom polietilenglikola (PEG) koji se koristi za indukciju osmotskog stresa u biljaka. Ovo istraživanje će pružiti uvid u mogućnosti primjene neinvazivne metode tretiranja sjemena u ranoj razvojnoj fazi, kao što je tretman plazmom, s ciljem poboljšanja tolerancije genotipova ozime pšenice na sušu. Nadalje, rezultati ovog istraživanja koristit će i oplemenjivačima pšenice u selekciji genotipova pšenice željenih svojstava.

Ključne riječi: tretman plazmom, plazma, pšenica, klijavost, suša

Impact of plasma pre-treatment on winter wheat genotypes

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Abstract

One of the approaches to increase the crop yield under abiotic stresses is to improve the seed germination. Chemical methods are often used for this purpose but due their negative impact on human health and environment, their usage should be minimized as much as possible. Plasma treatment is a new physical technology in agricultural practice, which can promote the seed germination and growth of seedlings. Plasma is a fourth aggregate state with zero net electric charge of particles. It changes the chemical properties of seed coat by creating a special wetting ability. In this study, effect of liquid-plasma with several radiofrequency on wheat genotypes under drought exposure will be tested. Before drought treatments seeds of two wheat genotypes will be soaked in liquid-plasma medium for several minutes. The effect will be tracked by measuring the germination rate, germination percentage, morphometric parameters such shoot and root length during several days under control and restricted water regime. The drought will be applied by using polyethylene glycol (PEG), a moisture deficit stress inducing media. This research will provide a potential of non-invasive plasma method in improving the drought tolerance of winter wheat genotypes in early developmental stage. Moreover, the results of this study may be beneficial for the breeders in selection of genotypes with best traits.

Key words: plasma pre-treatment, wheat, germination, drought

Rezultati ispitivanja novih Bc hibrida kukuruza u sortnoj komisiji RH

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Sažetak

Krajnji cilj svakog oplemenjivačkog procesa je razvoj novih inbred linija i komercijalnih hibrida kukuruza koji će zadovoljavati sve potrebe poljoprivrednih proizvođača. Da bismo to ostvarili potrebno je svake godine testirati na tisuće novih hibridnih kombinacija na više lokacija, od kojih se izdvoji samo nekoliko koje ćemo prijaviti u sortnu komisiju. Cilj ovog rada je ispitati nove Bc hibride kukuruza na prinos zrna i sadržaj vode u zrnu u 2018. godini u sortnoj komisiji RH. Pokusi su postavljeni na pet lokacija (Tovarnik, Beli Manastir, Osijek, Kutjevo i Šašinovec), u četiri ponavljanja, gdje je svaki hibrid posijan u četiri reda, a srednja dva su se brala. Dužina reda je bila 8 m. U 2018. godini ukupno smo u FAO grupama 300-600 ispitivali osam Bc hibrida. U FAO 300 najrodniji je bio hibrid BCEH8355 s prosječnih 13 t ha^{-1}, u FAO 400 BCEH8451 s 12,4 t ha^{-1}, u FAO 500 oba hibrida Majstor i BC526 imali su prinos od 12,3 t ha^{-1}, te u FAO 600 hibrid BCEH8671 ostvario je prosječni prinos od 13,3 t ha^{-1}. Svi ispitivani hibridi imali su veće prinose i manji sadržaj vode u zrnu u odnosu na prosjek dva standardna hibrida na svim lokacijama.

Ključne riječi: kukuruz, prinos zrna, testiranje

Results of testing new Bc maize hybrids in official trials in Croatia

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Abstract

The final goal of all maize breeding programs is to develop new inbred lines and new commercial maize hybrids which can satisfied all customer demands. To succeed in that job it is necessary to test a thousands of new hybrid combinations every year on several locations. From all of those tested hybrids we choose just a few best combinations for official trials. The aim of this study is to test our new maize hybrids for grain yield and moisture content in official trials in Croatia. Trials were planted on five locations (Tovarnik, Beli Manastir, Osijek, Kutjevo i Šašinovec) in four reps, where all hybrids were planted in four rows and the middle two were harvested. The length of the row was 8 m. In 2018 we tested eight maize hybrids from FAO 300 to 600 group. In FAO 300 the best yielding hybrid was BCEH8355 with average yield of 13 t ha^{-1}, in FAO 400 BCEH8451 with 12,3 t ha^{-1}, in FAO 500 both our hybrids Majstor and Bc526 yielded 12,3 t ha^{-1} and in FAO 600 hybrid BCEH8671 had average yield of 13,3 t ha^{-1}. All our tested hybrids over yielded the check hybrids with lower moisture content on all locations.

Key words: maize, grain yield, testing

Procjena otpornosti inbred linija kukuruza kokičara na fuzarijsku trulež klipa

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Sažetak

Trulež klipa kukuruza kokičara uzrokuje veći broj Fusarium vrsta, a jedna od najučestalijih je *F. verticillioides*. Patogen kontaminira zrno mikotoksinima što dovodi do gubitka prinosa i kvalitete. Učinkovit način kontrole bolesti je oplemenjivanje na otpornost. Vizualna selekcija na niži intezitet truleži klipa pretežito rezultira i nižim sadržajem toksina. Cilj ovoga rada bio je unutar elitne germplazme kukuruza kokičara izdvojiti izvore otpornosti na fuzarijsku trulež klipa. Procijenjena je otpornost 30 inbred linija u uvjetima prirodne i umjetne infekcije klipa. Umjetna infekcija klipa rađena je injektiranjem suspenzije spora *F. verticillioides* kroz komušinu u zrno. U berbi je procijenjen postotak zrna na klipu s vidljivim simptomima bolesti. Intenzitet truleži klipa je u prirodnoj infekciji bio nizak (1,5 %) i kretao se između linija u rasponu od 0 % do 19,1 %. Umjetna infekcija povećala je prosječnu trulež klipa na 16,9 % a intenzitet bolesti se kretao od 1.8 % do 52,8 %. Otpornost linija u prirodnoj infekciji bila je u korelaciji s otpornošću linija u umjetnoj infekciji (r=0,62). Međutim, za neke je linije utvrđena visoka otpornost u prirodnoj ali niska otpornost u umjetnoj infekciji, što potvrđuje da je za pouzdanu procjenu otpornosti potrebna umjetna infekcija klipa. Linije s najvišom razinom otpornosti (OS19, OS618) ulaze u testkrižanja za dobivanje komercijalnih hibrida i mogu se u oplemenjivanju kokičara koristiti kao izvor otpornosti na fuzarijsku trulež klipa.

Ključne riječi: kukuruz kokičar, inbred linije, trulež klipa, otpornost

Evaluation of Fusarium ear rot resistance in popcorn inbred lines

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Abstract

A complex of Fusarium spp. causes ear rot diseases in popcorn, and one of the most common is *F. verticillioides*. This pathogen causes losses in yield and quality, due to the contamination of grain by mycotoxins. Higher resistance to visual disease severities mostly results in lower toxin contamination. In order to identify sources of resistance to Fusarium ear rot in popcorn elite germplasm, 30 inbred lines were evaluated in natural and artificial ears infection. Primary ears were inoculated with *F. verticillioides* by injecting conidia suspension through the husk into the kernel wounds. At harvest time ears were rated for Fusarium ear rot severity (% of kernels with visible disease symptoms). Disease severity in natural infection was low. Inbreds had in average 1.5% of Fusarium ear rot and disease severity ranged from 0% to 19.1%. With kernel inoculations, a general increase in disease severity occurred. Inbreds had in average 16.9% of Fusarium ear rot and disease severity ranged from 1.8% to 52.8%. Inbreds resistance in natural infection correlated significantly with resistance in artificial infection (r=0.62). However, some inbreds showed high resistance in natural but low resistance in artificial infection which confirms that screening for ear rot resistance should be in artificial infection. Inbreds with highest resistance (OS19, OS618) are included in testcrosses for commercial hybrids and could be used as sources of resistance to Fusarium ear rot in further breeding.

Key words: popcorn, inbred lines, Fusarium ear rot, resistance

Relativna učinkovitost indirektne i direktne selekcije za prinos zrna pri niskoj i visokoj razini dušika kod ozime pšenice

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Sažetak

Informacija o ponašanju genotipova pšenice pri različitim razinama dušika (N) može pomoći u identifikaciji genotipova bolje prilagođenih niskim razinama N. Cilj rada bio je usporediti učinkovitost selekcije kod niske i visoke razine N kako bi se poboljšao prinos zrna pšenice u okolinama s niskim N. Šezdeset četiri genotipa ozime pšenice uzgajana su dvije godine na tri lokacije u Hrvatskoj pri dvije razine N (niski N i visoki N) dajući ukupno 12 N-okolina (godina × lokacija × razina dušika). Analiza varijance je pokazala značajne učinke genotipa, N-okolina i interakcije genotip × N-okolina na prinos zrna. Procjena heritabilnosti za prinos zrna kroz okoline bila je neznatno veća za niski N (0.79) nego za visoki N (0.72) i kretala se u rasponu od 0.42 do 0.89 u okolinama s niskim N te od 0.62 do 0.89 u okolinama s visokim N. Genetske korelacije između 12 N-okolina za prinos zrna bile su u rasponu od 0.31 do 0.99. Relativna učinkovitost indirektne selekcije spram direktne selekcije za svaki par okolina kretala se u rasponu od 0.27 do 1.45. Međutim, od 132 procjene relativne učinkovitosti indirektne selekcije spram direktne selekcije, 121 procjena bila je ispod 1.0, što ukazuje da je indirektna selekcija u većini slučajeva bila manje učinkovita od direktne selekcije. Rezultati ovoga rada ukazuju na potrebu uključivanja selekcijskih okolina s niskom razinom N u programe oplemenjivanja koji su usmjereni na okoline s niskom razinom N kako bi se maksimizirao odgovor na selekciju.

Ključne riječi: *Triticum aestivum* L., gnojidba dušikom, prinos zrna, genetske korelacije, odgovor na selekciju

Relative efficiency of indirect and direct selection for grain yield in low-N and high-N environments in winter wheat

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Abstract

Information on the performance of wheat genotypes under a range of nitrogen (N) levels can help to identify genotypes better adapted to low N environments. The present study assesses the efficiency of low N vs. high N selection environments to improve wheat grain yield for low-N environments. Sixty-four winter wheat genotypes were grown for two years at three locations in Croatia at two nitrogen levels (low N and high N) giving in total 12 N-environments (year × location × N level). Analysis of variance revealed significant effects of genotype, N-environment and genotype × N-environment interaction for grain yield. The mean broad-sense heritability estimate for grain yield across environments was slightly higher at high N (0.79) than at low N level (0.72) ranging from 0.42 to 0.89 in low N and from 0.62 to 0.89 in high N-environments. Genetic correlations between the 12 N-environments for grain yield were always positive ranging from 0.31 to 0.99. The relative efficiency of indirect selection to direct selection for each pair of environments ranged from 0.27 to 1.45. However, out of 132 estimates of relative efficiency of indirect selection to direct selection, 121 estimates were below 1.0, indicating that indirect selection in most situation was less efficient than direct selection. Results of the present study suggest the need for including low-N selection environments in breeding programs targeting low-N environments in order to maximize response to selection.

Key words: *Triticum aestivum* L., nitrogen fertilization, grain yield, genetic correlations, response to selection

Razvoj uljnih hibrida suncokreta u Poljoprivrednom institutu Osijek

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Sažetak

Oplemenjivački rad na suncokretu u Poljoprivrednom institutu Osijek u kontinuitetu traje 40-tak godina, s primarnim ciljem stvaranja hibrida uljnog tipa. Za realizaciju tog cilja bilo je neophodno stvaranje široke genetske osnove skupljanjem divergentnog materijala iz različitih zemalja svijeta. Stvaranje samooplodnih linija je neophodan segment oplemenjivačkog procesa pri čemu se najčešće koristi pedigree metoda. Stvorene linije se potom testiraju na opću i specifičnu kombinatornu sposobnost za najvažnija agronomska svojstva, a najbolje od njih se koriste u daljnjem procesu oplemenjivanja. Svake godine se stvori veliki broj novih hibridnih kombinacija koje se testiraju u mreži mikro i makropokusa, a najbolje od njih se prijavljuju za priznavanje. Prvi hibrid suncokreta Poljoprivrednog instituta Osijek, 'Osječanin', priznat je 1985. godine. Nakon toga priznato je još 13 hibrida od kojih su neki zauzimali značajno mjesto u strukturi sjetve u Republici Hrvatskoj. Kontinuirani rad na genetskom unapređenju linija i hibrida suncokreta prepoznat je i kroz novi hibrid 'Matej' koji je priznat 2016. godine. Hibrid 'Matej' odlikuje visoki potencijal uroda zrna (preko 5,5 t ha-1), dobra stabilnost i adaptabilnost, tolerantnost na biotske i abiotske stresove te visoki sadržaj ulja (preko 52 %). Osim hibrida priznatih u Republici Hrvatskoj, Poljoprivrednom institutu Osijek su priznata četiri hibrida suncokreta i u inozemstvu.

Ključne riječi: suncokret, oplemenjivanje, hibrid, stabilnost, ulje

Development of sunflower oil hybrids at the Agricultural Institute Osijek

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Abstract

Sunflower breeding program at the Agricultural Institute Osijek has forty years long tradition in continuity with the primary goal of oil hybrids development. To achieve this goal, it was necessary to create a broad genetic basis by collecting divergent material from different countries of the world. Development of inbred lines is an essential segment of the breeding process where the Pedigree method is the most commonly used. The created lines are then tested for general and specific combinational ability for the most important agronomic properties, and the best lines are used in the further breeding process. Every year a large number of hybrid combinations was created, and tested in micro and macro experiments, and the best of them applies for recognition. The first sunflower hybrid of the Agricultural Institute Osijek, 'Osječanin', was recognized in 1985. Thereafter, 13 hybrids were recognized, some of them having a significant place in the sowing structure in the Republic of Croatia. Continuous work on the genetic improvement of sunflower lines and hybrids has also been recognized through the new hybrid 'Matej', which was recognized in 2016. Hybrid 'Matej' has high grain yield potential (over 5.5 t ha-1), good stability and adaptability, tolerance to biotic and abiotic stresses and high oil content (over 52%). In addition to the hybrids recognized in the Republic of Croatia, the Agricultural Institute of Osijek has four sunflower hybrids recognized abroad.

Key words: sunflower, breeding, hybrid, stability, oil

Nacionalna baza podataka biljnih genetskih izvora u Hrvatskoj

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Sažetak

Nacionalni program očuvanja i održive uporabe biljnih genetskih izvora za hranu i poljoprivredu u Republici Hrvatskoj za razdoblje od 2017. do 2020. godine donešen je odlukom Vlade R.Hrvatske od 26. siječnja 2017. Aktivnosti Nacionalnog programa usmjerene su prvenstveno na domaće biljne genetske izvore (autohtone sorte i populacije, sorte stvorene oplemenjivanjem u Republici Hrvatskoj) te u manjoj mjeri na sorte stranog podrijetla koje su udomaćene i imaju dugu tradiciju uzgoja. Nacionalnim programom obuhvaćena je većina značajnih institucija u Republici Hrvatskoj koje se na neki način bave biljnim genetskim izvorima (HCPHS – Zavod za sjemnarstvo u rasadničarstvo te Zavod za voćarstvo i povrćarstvo; Agronomski fakultet, Zagreb; Fakultet biotehničkih znanosti, Osijek; Institut za jadranske kulture i melioraciju krša, Split; Institut za poljoprivredu i turizam, Poreč; Visoko gospodarski učilište, Križevci; Podravka d.d., Koprivnica; Poljoprivredni institut,Osijek; Bc Institut, Zagreb te Sveučilište u Dubrovniku, Zavod za mediteranske kulture).

Kako bi podaci o čuvanim biljnim genetskim izvorima bili dostupni svim sudionicima Nacionalnog programa, kao i široj javnosti, razvijen je informacijski sustav za biljne genetske izvore kojeg predstavlja Hrvatska baza podataka biljnih genetskih izvora (Croatian Plant Genetic Resources Database – CPGRD). Podatci o primkama koji se trebaju voditi u bazi uključuju putovničke podatke, prikupljačke podatke, podatke o opisu i procjeni svojstava te o rukovanju primkama.

Podatci iz hrvatske Nacionalne inventarizacije dostupni su i u europskoj bazi EURISCO od 2009. godine. Trenutno CPGRD broji 3 785 primki (žitarice i kukuruz – 378 primki, industrijsko bilje – 63 primke, povrće – 99 primki, krmno bilje – 197 primki, voćne kulture – 381 primku, vinova loza – 147 primki te ljekovito i aromatično bilje 2 520 primki).

Ključne riječi: nacionalni program, biljni genetski izvori, baza podataka, primka

National Inventory of Plant Genetic Resources in Croatia

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Abstract

The National Program for the Conservation and Sustainable Use of Plant Genetic Resources for Food and Agriculture in the Republic of Croatia for the period 2017 to 2020 was enact by the decision of the Government of the Republic of Croatia of 26 January 2017. The activities of the National Program are directed primarily at domestic plant genetic resources (autochthonous varieties and populations, varieties created by breeding in the Republic of Croatia) and to a lesser extent on varieties of foreign origin that are indigenous and have a long tradition of cultivation. The National Program covers most significant institutions in the Republic of Croatia that are in some way engaged in plant genetic resources (CCAFRA – Institute for Seed and Seedlings and the Institute for Pomology and Vegetables; Faculty of Agriculture, Zagreb; Faculty of Biotechnical Sciences, Osijek; Institute for Adriatic Crops and Kars Reclamation, Split; Institute for Agriculture and Tourism, Poreč, Higher Economic College, Križevci; Podravka d.d., Koprivnica; Agricultural Institute, Osijek; Bc Institute, Zagreb and University of Dubrovnik, Institute for Mediterranean Crops).

In order to ensure that data on conserved plant genetic resources are available to all participants in the National Program as well as to the wider public, an information system for plant genetic resources was developed and it is presented as Croatian Plant Genetic Resources Database (CPGRD). Data on accessions which should be in database include passport data, collection data, descriptive data and estimation of characteristics as well as data on handling of accessions.

Data from the Croatian National Inventory are also available at the European database EURISCO since 2009. At the moment, the CPGRD includes 3 785 accessions (Cereals and maize - 378 accessions, Industrial crops - 63 accessions, Vegetables - 99 accessions, Fodder crops - 197 accessions, Fruit crops - 381 accessions, Vitis - 147 accessions and Medicinal and aromatic plants – 2 520 accessions).

Key words: national program, plant genetic resources, database, accessions

Usporedba metoda izmjere morfometrijskih svojstava zrna ozime pšenice

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Sažetak

Proučavanje morfoloških svojstava zrna ozime pšenice ima veliki značaj u procesu oplemenjivanja. Pored najčešće procjenjivane mase sjemena, veličina i oblik zrna postaju sve značajnija svojstva od interesa u oplemenjivačkim programima, jer su uz masu najvažnije odrednice prinosa i kvalitete zrna. U novije se vrijeme analiza digitalnih zapisa pokazala vrlo učinkovitim alatom prikupljanja podataka o morfološkim svojstvima zrna. Cilj rada je bio istražiti osnovna morfometrijska svojstva sjemena (dužina, širina i površina) 20 sorti ozime pšenice Poljoprivrednog instituta Osijek (uzorak od 25 zrna/sorti) putem dvije metode: (I) fotografiranjem uzorka na polimeriziranoj crnoj glini uz LED rasvjetu te obradom digitalnog zapisa pomoću javno dostupnog računalnog programa ImageJ te (II) obradom istog uzorka zrna uređajem MARVIN (GTA Sensorik GmbH, Germany). Dobiveni podaci dviju metoda su se u prosjeku razlikovali od 1,18 % za duljinu do 4,80 % za površinu sjemena. Statistički značajne razlike nisu utvrđene za duljinu i širinu dok je statistički značajna razlika (p=0,01) utvrđena za površinu zrna. Prosječno više vrijednosti za površinu i duljinu su dobivene metodom I, a za širinu metodom II. Korelacije promatranih morfometrijskih svojstava s masom tisuću zrna su za obje metode bile pozitivne značajne do vrlo značajne (I r=0,57**-0,75**; II r=0,52*-0,70**). Rezultati ukazuju na učinkovitost i pouzdanost korištenja obje metode u prikupljanju podataka o morfometrijskim svojstvima zrna pšenice, ali i zahtijevaju daljnja istraživanja.

Ključne riječi: metode izmjere, digitalna analiza, morfometrija, zrno, pšenica

Comparison of measuring methods for morphometric traits of winter wheat kernel

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Abstract

Studying the morphological traits of winter wheat kernel is of great importance in the breeding process. In addition to the most commonly studied seed mass, kernel size and shape become more and more important traits of interest in breeding programs, because they are kernel yield and quality determinants. Recently, the analysis of digital records has shown a very efficient data gathering tool for morphological traits of kernel. The aim of the paper was to investigate the basic morphometric traits of seeds (length, width and area) of 20 winter wheat varieties of the Agricultural Institute Osijek (sample of 25 kernels/variety) by two methods: (I) photographing the sample on a polymerized black clay with LED lighting and processing of digital records using freely available software ImageJ and (II) treating the same kernel sample with the device MARVIN (GTA Sensorik GmbH, Germany). The data obtained from the two methods differed on average from 1.18% for the length up to 4.80% for the seed area. Statistically significant differences were not revealed for length and width while a statistically significant difference ($p = 0.01$) was determined for the area of the kernel. Average higher values for area and length were obtained by method I and for width by method II. Correlations between observed morphometric traits and thousand seed weight were significantly and very significantly positive for both methods (I r=0.57**-0.75**; II r=0.52*-0.70**). The results indicate the efficacy and reliability of using both methods in collecting data on the morphometric traits of wheat, but also require further research.

Key words: methods of measuring, digital analysis, morphometry, kernel, wheat

Sjemenska proizvodnja soje u Republici Hrvatskoj

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Sažetak

Soja je, nakon pšenice, najraširenija vrsta u proizvodnji sjemena u Republici Hrvatskoj. Sjemenska proizvodnja soje u Republici Hrvatskoj u posljednjih 10 godina odvijala se na površinama od 2.809 ha (2010. godine) do 5.320 ha (2018. godine), s prosječnim prinosom sjemena 3.118 kg ha-1. U Hrvatskom centru za poljoprivredu hranu i selo - Zavodu za sjemenarstvo i rasadničarstvo prijavljeno je za stručni nadzor sjemenske soje u 2018. godini 5.320 ha što je povećanje u odnosu na 2017. godinu za 15 %, a u odnosu na desetogodišnji prosjek povećanje za 35 %. Prosječni prinosi sjemena soje kretali su se od 2.438 kg ha-1 u 2012. godini do 4104 kg ha-1 u 2018. godini. U desetogodišnjem razdoblju ukupno se sjemenarilo sa 82 sorte, od čega se 46 sorti odnosilo na sorte hrvatskih oplemenjivača, a 36 sorti se odnosilo na sorte stranih oplemenjivača. U upisnik dobavljača poljoprivrednog sjemena ukupno je upisano 986 subjekata, a proizvodnju sjemena soje u proteklih deset godina prijavljivalo je od 43 do 99 proizvođača godišnje.

Ključne riječi: soja, proizvodnja sjemena, površine, prinos sjemena

Soybean seed production in Republic of Croatia

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Abstract

Soybean, after wheat, is the most common species in the production of seeds in the Republic of Croatia. Soybean seed production in the Republic of Croatia in the last 10 years took place in areas of 2.809 ha (2010 year) to 5.320 ha (2018 year), with an average seed yield 3.118 kg ha^{-1}. The Croatian Center for Agriculture Food and Rural Affairs - Institute for Seeds and Seedlings 5.320 ha were reported for supervision of seed soybeans in 2018., which is an increase of 15% in relation to 2017, and increase of 35% comparing to the ten-year average. Average yields of soybean seeds ranged from 2.438 kg ha^{-1} in 2012 to 4.104 kg ha^{-1} in 2018. In the ten year period, the seeds of 82 varieties were produced, out of which 46 varieties are varieties of Croatian breeders, and 36 varieties are varieties of foreign breeders. A total of 986 subjects have been entered in the register of agricultural seed suppliers, and the production of soybean seeds have reported by 43 to 99 producers per year in the past ten years.

Key words: soybean, seed production, areas, seed yield

Međuzavisnost komponenti prinosa i kvalitete zrna soje

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Sažetak

U poljskim pokusima tijekom dvije godine je ispitivana varijabilnost i međuzavisnost osnovnih komponenti prinosa i kvaliteta zrna soje. U istraživanja je bilo uključeno 74 kultivara soje različitih grupa zriobe (000 do II) koje se koriste u komercijalnoj proizvodnji diljem Europe. Istraživanja su rađena po biljkama te je utvrđena varijabilnost i prosječne vrijednosti za svojstva visine biljke, broj mahuna, broj zrna masa zrna, zrna po mahuni, masa 1000 zrna, broj dana od nicanja do cvatnje, broj dana od nicanja do zriobe te udio proteina i udio ulja. Analizom varijance utvrđene su statistički opravdana razlike za sva istraživana svojstva između kultivara te kultivara i godina na nivou značajnosti ($p<0,01$). Istraživanja su pokazala da su masa zrna po biljci i broj zrna po biljci najviše varirali (10,70 i 9,67 %), dok je broj dana od nicanja do zriobe najmanje varirao (0,13 %). Utjecaj okoline imao je najveći utjecaj na komponente prinosa dok je najmanje utjecao na svojstva kvalitete zrna soje. Stoga se na osnovu analiziranih svojstava može pretpostaviti da su rane komponente prinosa (broj mahuna i broj zrna po biljci) jače pod utjecajem okoline od kasnih komponenti (broj zrna po mahuni i masa 1000 zrna) te svojstava kvalitete. Korelacije između analiziranih svojstava ukazuju da se veći prinosi po biljci postižu sa većim brojem mahuna i zrna po biljci. S povećanjem udjela ulja smanjuje se udio proteina u zrnu soje. Ostvareni rezultati u značajnoj mjeri mogu poslužiti kao osnova za daljnji rad na unapređenju proizvodnje te izbjegavanja stresnih uvjeta u kritičnim fazama razvoja različitim agrotehničkim zahvatima.

Ključne riječi: soja, komponente prinosa, kvaliteta, međuzavisnost

The interdependence of yield components and the quality of soybean grain

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Abstract

Variability and interdependence of the main components of yield and quality of soybean grain were studied in field trials over two years. The study included 74 soybean cultivars of different maturity groups (000-II) used in the commercial production throughout Europe. Research was done on plants, and the variability and average values for plant height, number of pods, number of grain, grain weight, number of grain in pod, 1000 grains weight, number of days from emergence to flowering, number of days from emergence to maturity and protein and oil content were determined. Analysis of variance showed statistically significant differences for all studied traits between cultivars and cultivars and years on the level of significance ($p < 0.01$). Studies have shown that the grain weight per plant and the number of grains per plant most varied (10.70 and 9.67%), while the number of days from emergence to maturity varied the least (0.13%). The influence of the environment had the strongest impact on the yield components, while it was least influencing the properties of soybean grain quality. Therefore, on the basis of the analysed properties it can be assumed that the early yield components (number of pods and number of grains per plant) are more influenced by the environment from the late components (number of grains per pod and 1000 grains weight) and quality properties. The correlations between the analysed components indicate that higher yields per plant are achieved with a greater number of pods and grains per plant. Increasing the oil content reduces the share of protein in soybean grain. The results obtained can significantly serve as a basis for further work on improving production and avoiding stress conditions at critical phases of development with various agrotechnical interventions.

Key words: soybean, yield components, quality, interdependence

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Zbornik sažetaka

Povrćarstvo, ukrasno, aromatično i ljekovito bilje

Effect of amendments' application on Lemon balm mineral content

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Abstract

Lemon balm (*Melissa officinalis* L.) is a perennial herbaceous plant in the mint family Lamiaceae. It has leaves with a mild lemon scent similar to mint. The leaves are used as a herb, in teas, and also as a flavouring. Lemon balm tea, the essential oil, and the extract are used in traditional and alternative medicine. Amendments can be used for foliar treatments of plants with purpose of plant nutrition in order to improve growth and development of plant, and accordingly enhancing the yield and quality. Therefore, the goal of present research was to determine the effect of foliar treatments of biostimulants and amendments on mineral composition of lemon balm. A field trial was set up in 2018 in Zagreb on 3-years-old lemon balm plantation according to the Complete Random Block Design method with six treatments (EkoBooster 2, Lord Grow, Ecogreen, Kristalon Green, Drin, Control). The highest mineral values are achieved by using Lord Grow treatment. However, overall determined mineral values in the lemon balm leaves on dry matter basis are as follows: 0.24-0.29 % P, 2.43-3.22 % K, 1.70-2.09 % Ca, 0.41-0.52 % Mg, 341-493 mg Fe/kg, 19.57-25.19 mg Zn/kg, 48.5-99.5 mg Mn/kg and 10.33-14.50 mg Cu/kg.

Keywords: macronutrients, medicinal plant, Melissa officinalis, micronutrients, minerals

Minimalna prerada krumpira

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Sažetak

Cilj ovoga priopćenja je dati pregled o minimalnoj preradi krumpira počevši od osnovne definicije minimalne prerade, značaja proizvoda, opisa procesa proizvodnje minimalno procesiranog krumpira (MPK) i uvjeta čuvanja do poteškoća koje se javljaju i mogućih rješenja za prevladavanje istih. Ubrzani tempo života u razvijenim zemljama utječe na porast ponude i potražnje polugotovih i gotovih jela u koje se može ubrojiti i minimalno prerađeno voće i povrće (ViP). Ono se definira kao oguljeno, narezano, 100% upotrebljivo, zapakirano, praktično i izvornog okusa i svježine. Ponuda tih proizvoda je u razvijenim zemljama i Hrvatskoj u porastu. Taj rast na hrvatskom tržištu nije jednak za sve vrste ViP, npr. MPK se nalazi u zanemarivim količinama. Proces proizvodnje MPK u osnovi je jednostavan, tj. obuhvaća operacije primarne prerade i pakiranja, ali takvi proizvodi skloni su brzom propadanju što otežava proizvodnju, kao i čuvanje, jer zahtjeva održavanje hladnog lanca. S tim u vezi provode se mnoga znanstvena istraživanja u cilju odabira adekvatne sorte najmanje sklone posmeđivanju, odabira sredstava protiv posmeđivanja, ambalaže pogodne propusnosti te atmosfere koja će usporiti procese disanja i kvarenja i na taj način omogućiti rok trajanja proizvoda za maloprodaju barem 7 dana, a i duže. Međutim, univerzalnog rješenja nema, već se temeljem dosadašnjih saznanja za odabranu sortu trebaju dodatno utvrditi uvjeti prerade i čuvanja koji bi doprinijeli maksimalnoj stabilnosti proizvoda.

Ključne riječi: *Solanum tuberosum*, minimalno prerađeni krumpir, proizvodnja, sprječavanje posmeđivanja, pakiranje

Minimally processing of potato

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Abstract

The aim of this communication is to provide an overview of potato minimally processing, starting with the basic definition of minimal processing, product relevance, description of the minimally processed potato (MPP) manufacturing, its storage conditions as well as the some difficulties and possible solutions for overcoming them. The nowadays lifestyle in developed countries affects the growing trend of supply and demand for semi-prepared and ready-to-eat meals, including minimally processed fruit and vegetables (ViP). It is defined as cleaned, and 100% usable, packed, convenient with authentic taste and freshness. The offer of such products in developed countries, as well as in Croatia, is growing. Although, market growth in Croatia is not the same for all ViP types, e.g. MPP is present in negligible quantities. Processing of MPP is basically simple, including operations of primary processing, and packaging but the rapid perishability of such product makes it difficult for production and requires storage with the cold chain maintenance. In this regard, many scientific papers dealt with the appropriate cultivar selection that is least prone to browning, as well as the selection of anti-browning agents, suitable package material and atmosphere that will slow respiration and deterioration processes and in that way enable shelf life of a minimum 7 days or longer, if the product is intended for retail. However, there is no unique solution, but it is necessary to establish optimal processing and storage conditions for selected cultivar according to previous studies, that will contribute to greater product stability.

Key words: *Solanum tuberosum,* minimally processed potato, production, browning prevention, packaging

Senzorska procjena različitih oparaka od aromatičnog bilja

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Sažetak

U prošlosti i sadašnjosti čovjek je bio okružen i ovisan o ljekovitom bilju. Postepeno ga je upoznavao i to prvo za liječenje, a kasnije i za ishranu. U preradi aromatičnog bilja uglavnom se koriste samo oni dijelovi biljke (npr. plod, cvijet, list, stabljika, korijen, gomolj itd.) koji sadrže aktivne tvari. Čaj se može prirediti kao oparak, uvarak, provarak i naljev. Uglavnom se većina čajeva pripravlja kao oparak ili infuz. U općem dijelu rada su opisane biološke i kemijske karakteristike aromatičnog bilja čiji su oparci korišteni za senzorsku procjenu, a to su: lavanda, lipa, kamilica, paprena metvica (menta), komorač, kadulja i majčina dušica. U praktičnom dijelu rada metodom senzorske procjene potrošača obavljena je procjena oparaka od gore navedenih vrsta aromatičnog bilja (u filtar vrećicama á 20 g) tvrtke Franck d. o. o, što je ujedno i cilj ovoga rada. Senzorska procjena je provedena tijekom druge polovice 2018. godine na uzorku od 20 studenata Veleučilišta „Marko Marulić“ u Kninu. Rezultati procjene su pokazali sljedeće: ispitanici su ocjenom dovoljan ocijenili oparak od kadulje. Oparci od lavande, majčine dušice i lipe su ocijenjeni ocjenom dobar, a oparke od: mente, kamilice i komorača ispitanici su ocijenili s ocjenom vrlo dobar.

Ključne riječi: aromatične vrste, aromatični oparci, senzorska procjena

Sensory evaluation of different infusions from aromatic herbs

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Abstract

Both in the past and in the present humans have been surrounded and dependent on medicinal herbs. They gradually gained a deeper insight into them, primarily for the purpose of curing and subsequently also in order to use it as food. Normally only the parts of the plant that contain active substances (e.g. fruit, flower, leaf, stem, root, tuber, etc.) are used in the processing of aromatic plants. Tea can be prepared as an infusion, decoction, extraction through cooking and maceration. Most teas are prepared as an infusion. The general part of the paper provides a description of biological and chemical characteristics of aromatic plants whose infusion had been used for sensory evaluation, such as: lavender, linden, chamomile, peppermint (mint), fennel, sage and thyme. In the practical segment of the paper, the method of consumer sensory evaluation was used to evaluate the infusions made from the previously mentioned species of aromatic plants (in sachets á 20 g) produced by the company Franck d. o. o., which was simultaneously also the objective of this paper. Sensory evaluation was conducted during the second half of 2018 on a sample of 20 students attending Marko Marulić Polytechnic in Knin. According to the evaluation results, sage infusion was graded as sufficient by the respondents. Infusions from lavender, thyme and linden were graded as good, whereas infusions from mint, chamomile and fennel were graded as very good by the respondents.

Key words: aromatic species, aromatic infusions, sensory evaluation

Utjecaj koncentracije i sastava hranjive otopine na vegetativna svojstva presadnica cijepljene rajčice

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Sažetak

Cilj rada bio je utvrditi utjecaj koncentracije i sastava hranjive otopine (HO) na vegetativna svojstva presadnica cijepljene rajčice. Pokus je postavljen sa presadnicama rajčice kultivar 'Belle F1' necijepljen (B), cijepljen na vlastiti korijen (B/B) te podloge Arnold (B/A) i He-Man (B/H). Hranjiva otopina (sastav: 1,25 mM NH4+, 12,71 mM NO3-, 1,25 mM H2PO4-, 8,75 mM K+, 2 mM Mg2+, 4,25 Ca2+, 1,75 mM SO42-, 15 µM Fe 2+, 10 µM Mn2+, 5 µM Zn2+, 0,5 µM Mo+, 0,75 µM Cu2+ i 30 µM B+) primijenjena je u tri koncentracije: EC 3 i EC 6 dSm-1 te EC 3 HO + 3 NaCl (EC 6 NaCl) kod koje je u hranjivu otopinu EC 3 dodan NaCl do ciljanog EC-a. Visina (19,7 cm) i broj listova (6,7 listova) manji su kod presadnica B u usporedbi sa ostalim podlogama. Presadnice tretirane sa EC 3 dSm-1 značajno su većeg promjera stabljike od presadnica tretiranih sa EC 6 NaCl. Necijepljene presadnice značajno su manjeg promjera stabljike u usporedbi s cijepljenim presadnicama. Najveći indeks koncentracije klorofila zabilježen je kod presadnica tretiranih sa EC 6 dSm-1. Površina listova presadnica bila je pod utjecajem oba faktora. Presadnice B/H ostvarile su veću površinu listova od presadnica B bez obzira koja je HO primijenjena. Nadalje, najdeblji listovi zabilježeni su na presadnicama tretiranim sa EC 6 NaCl (365 cm2g-1). Cijepljene presadnice bolje izbjegavaju stres solima od necijepljenih, dok je tolerantnost prema vrsti soli u ovisnosti o primijenjenoj podlozi.

Ključne riječi: električna provodljivost, natrijev klorid, rajčica cv. 'Belle F1', stres soli

Influence of nutrient solution concentration and composition on vegetative properties of tomato grafted transplants

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Abstract

The aim of the study was to determine the influence of nutrient solution concentrations and composition (NS) on the vegetative properties of tomato transplants. The experiment was set up with tomato, cultivar 'Belle F1', non-grafted (B), self-grafted (B/B) and grafted onto rootstock Arnold (B/A) and He-Man (B/H). Nutrient solution for transplant production (composition: 1.25 mM NH4+, 12.71 mM NO3-, 1.25 mM H2PO4-, 8.75 mM K+, 2 mM Mg2+, 4.25 Ca2+, 1.75 mM SO42-, 15 μM Fe2+, 10 μM Mn2+, 5 μM Zn2+, 0.5 μM Mo+, 0.75 μM Cu2+ and 30 μM B+) were applied in three concentrations: EC 3, EC 6 dSm-1 and EC 3 NS + 3 NaCl (EC 6 NaCl) in which a NaCl solution was added to the EC 3 NS to achieve target EC (6 dSm-1). The height (19.7 cm) and leaves number (6.7 leaves) were lower in non-grafted transplants compared to grafted ones. Transplants treated with EC 3 dSm-1 had significantly larger stem diameter than transplant treated with EC 6 NaCl dSm-1. Non-grafted transplant had significantly smaller stem diameter than grafted ones. The highest chlorophyll content index was recorded by transplant treated with EC 6 dSm-1 (36.4). The transplants leaf area was influenced by both factors. Transplants B/H had a larger leaf area than B transplants regardless of which NS were applied. The leaves thickest were recorded on the transplants treated with EC 6 NaCl (365 cm2g-1). Grafted transplants better alleviate salts stress than non-grafted transplants, while tolerance to the salt type depends on the used rootstock.

Key words: electrical conductivity, grafting, sodium chloride, tomato cv. 'Belle F1', salts stress

Kvaliteta glavice istarskog ljubičastog i žutog luka pri različitim razmacima sadnje

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Sažetak

Luk (*Allium cepa* L.) je važan povrćarski usjev sa svjetskom proizvodnjom od 93 168 548 tona. U Hrvatskoj je u 2016. proizvedeno preko 26 858 tona luka u glavicama sa prosječnim prinosom koji prelazi 32 t ha^{-1}. Ključna odluka koju uzgajivači luka moraju donijeti je utvrđivanje optimalne gustoće sadnje koja određuje trošak, prinos i kvalitetu usjeva. Cilj ovog istraživanja je bio procijeniti utjecaj različitih razmaka unutar i između reda na karakteristike glavice istarskog ljubičastog i žutog luka. Poljski pokus je proveden tijekom dvije vegetacijske sezone. Pokus je postavljen kao randomizirani blok dizajn sa dva faktora: 20, 30 i 50 cm razmaka između redova, te 10, 15 i 20 cm razmaka unutar reda. Masa glavice istarskog ljubičastog i žutog luka povećala se s povećanjem razmaka između redova, dok je razmak unutar reda imao značajan utjecaj samo kod žutog luka. Utjecaj razmaka između redova imao je sličan učinak na visinu i promjer glavice istarskog ljubičastog i žutog luka. Sadržaj flavonoida, antocijana i šećera je kod oba genotipa bio pod manjim utjecajem razmaka unutar i između reda u odnosu na morfološke karakteristike glavice. Ovi rezultati ukazuju da je moguće prilagoditi gustoću sadnje istarskog ljubičastog i žutog luka kako bi se proizvele glavice koje odgovaraju tržišnoj potražnji bez značajnih promjena u kvaliteti glavice.

Ključne riječi: *Allium cepa* L., morfološke karakteristike glavice, fitotvari

Istrian purple and yellow onion bulb quality at different plant spacing

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Abstract

Onion (*Allium cepa* L.) is an important vegetables crop with a worldwide production of 93 168 548 tons while in 2016 in Croatia 26 858 tons of dry bulb onion were harvested, with an average yield exceeding 32 t ha^{-1}. Critical decision that onion growers must address is optimization of plant density which determines cost, plant yield and bulb quality. Objective of this study was to evaluate the effects of different within and between row spacing's on Istrian purple and yellow onion bulb characteristics. The field experiment was conducted during two vegetative seasons and was set up as a randomized block design with two factors: 20, 30 and 50 cm between row spacing and 10, 15 and 20 cm within row spacing. Bulb weight increased as between row spacing increased for Istrian purple and red onion, while in row plant spacing had significant effect only for yellow onion. Row spacing had similar effect on Istrian purple and yellow onion bulb height and diameter. Flavonoid, anthocyanin and sugar content of both genotypes were less affected by different row spacing's than observed bulb morphological traits. These results suggest that it is possible to adjust planting density of Istrian purple and yellow onion in order to obtain marketable bulbs without significant changes in bulb quality.

Key words: *Allium cepa* L., bulb morphological traits, phytochemicals

Analiza mogućnosti primjene autohtonih trajnica u uređenju javnih površina

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Sažetak

Cvjetne gredice imaju značajnu ulogu u uređenju javnih zelenih površina kao vizualno najuočljiviji element dizajna. Primjena jednogodišnjih i dvogodišnjih cvjetnih vrsta te geofita na gredicama predstavlja sve značajniji trošak u uređenju i održavanju zelenih javnih površina te se traže jeftinija rješenja. Jedno od takvih svakako je primjena trajnica na način koji se devedesetih godina prošlog stoljeća pojavio u Nizozemskoj i proširio se svijetom tzv. novi stil primjene trajnica („new perennial style") koji uključuje sadnju visokih trava i trajnica, od kojih su mnoge autohtone. Ovim je načinom sadnje stvorena mogućnost jeftinijeg, ali i dovoljno atraktivnog uređenja cvjetnih gredica na javnim površinama gradova. Cilj ovog rada je dobiti uvid u izbor biljnih vrsta koje se primjenjuju u uređenju javnih površina u Zagrebu, Beču i Münchenu te izrada prijedloga primjene autohtonih trajnica za uređenje gredica. Područje istraživanja Hugo Wolf Parka i Westparka je, na temelju Hansenove podjele trajnica prema staništima, obuhvaćalo trajnice za sunčane položaje na gredicama te kamenjare. Najčešće primijenjene vrste u Hugo Wolf parku su iz porodice *Asteraceae*, a česti su i rodovi *Geranium* i *Chrysopsis*. U Westparku su najzastupljenije vrste rodova: *Hosta, Ajuga, Euphorbia, Geranium, Allium, Paeonia, Bergenia, Brunnera, Phlox* i *Veronica*. Dok su u Westparku i Hugo Wolf Parku brojne gredice s autohtonim trajnicama, u Zagrebu to nije slučaj jer prevladavaju alohtone vrste.

Ključne riječi: javne površine, gredice, trajnice

Analysis of possibilities of using autochthonous perennials in the design of public green areas

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Abstract

Flower beds play a significant role in arranging public green areas as the most visible design element. The application of annuals and biannuals combined with geophytes in the beds represents a more significant expense in the design and maintenance of green public spaces and it is necessary to look for cheaper but equally efficient solutions. One of these is certainly the application of perennials in the way that appeared in the Netherlands in the nineties of the last century and spread to the so called a 'new perennial style' that includes planting tall grasses and perennials, many of which are autochthonous. This way of planting has enabled the possibility of cheaper but also attractive arrangement of flower beds on public areas of the cities. The aim of this paper is to gain insight into the choice of plant species that are applied in the design of flower beds in public green areas in Zagreb, Vienna and Munich and making proposals for the use of autochthonous perennials for arranging beds. Based on Hansen's division of perennial habitats, the Hugo Wolf Park and Westpark area are covered by the perennials of sunny plains on beds and rocks. The most widely used species in the Hugo Wolf Park are from the *Asteraceae* family and the genera *Geranium* and *Chrysopsis*. In Westpark species from the genera *Hosta, Ajuga, Euphorbia, Geranium, Allium, Paeonia, Bergenia, Brunnera, Phlox* and *Veronica* prevail. While in Westpark and Hugo Wolf Park there are numerous flower beds with autochthonous species, in Zagreb this is not the case, due to allochthonous species prevail.

Keywords: public areas, flower beds, perennials

Widening spectrum of fungal pathogens: increased threat to mushroom cultivation

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Abstract

In 2004 *Trichoderma aggressivum* f. *europaeum* was detected at a Hungarian button mushroom (*Agaricus bisporus*) farm with green mould, while in 2010 *T. harzianum* was identified in Croatia. The same species was found to cause infections of shiitake in Hungary and Serbia. Recently *T. aggressivum* f. *aggressivum* was detected, so far reported only in North America, causing unexampled loss of *A. bisporus* crop in Hungary. Green mould infections of oyster mushroom with *T. pleuroti* and *T. pleuroticola* in various countries were ascribed while in Croatia *T. harzianum* was found in high proportion, and in Hungary the presence of *T. aggressivum* f. *aggressivum* was discovered recently. At two Hungarian farms whitish mould infections, resulting in extreme button mushroom yield losses, were attributed lately to *T. decipiens*, known in association only with shiitake before. The cobweb disease of *A. bisporus* is caused by *Cladobotryum mycophilum* in Hungary and Serbia, rather than *C. dendroides*. This research indicates that the spectrum of mould species infecting mushrooms is widening, subjecting growers to an increasing challenge.

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Key words: mushroom diseases, *Trichoderma aggressivum*, *T. harzianum*, *T. decipiens*, *Cladobotryum mycophilum*

Carbon source utilization profiles of mushroom-pathogenic moulds

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Abstract

Moulds causes significant mushroom crop losses word-wide. For the development of efficient control strategies, precise species identification and detailed characterization of the causal agents are essential. In this research the capability of different moulds isolated from button mushroom (*Agaricus bisporus*) farms (and identified by ITS sequence analysis) were tested to utilize a wide range of carbon sources in plate assays and BIOLOG Phenotype Microarrays. Several different sugars, amino and other acids inhibited mycelial growth of *Trichoderma aggressivum* isolates, but the majority of them had strong negative effect also on *A. bisporus*. The only exception was L-sorbose, which caused 61-100% growth inhibition of *T. aggressivum*, with only little negative effect on *A. bisporus* (5% growth inhibition), suggesting that it might be a potential agent to control green mould disease. No carbon source caused remarkable growth inhibition of *Lecanicillium fungicola* strains without impairing button mushroom, although mycovirus-containing isolates showed reduced growth in the presence of certain sugars, amino and other acids compared to mycovirus-free strains.

This research was supported by grant NKFI K-116475 (National Research, Development and Innovation Office), as well as by the Hungarian Government and the European Union within the frames of the Széchenyi 2020 Programme (GINOP-2.2.1-15-2016-00006).

Key words: *Agaricus bisporus*, button mushroom, *Trichoderma*, *Lecanicillium*, carbon source utilization

Utjecaj koncentracije dušika i cijepljenja na vegetativna i generativna svojstva rajčice

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Sažetak

Cilj rada bio je utvrditi utjecaj smanjenja koncentracije dušika (N) u hranjivoj otopini te cijepljenja na vegetativna i generativna svojstva rajčice kultivara 'Belle F1'. Biljke, necijepljene ili cijepljene na podlogu Arnold, posađene su u blokove kamene vune, a potom tretirane s tri koncentracije N: 75, 140 i 205 mgL^{-1}. Imale su po dvije formirane stabljike (glavni i postrani izboj) i po pet cvjetnih etaža. Biljke tretirane sa 140 mgL^{-1} N su bile više i imale su više listova od biljaka uzgajanih na 205 mgL^{-1} N. Broj listova na postranom izboju bio je veći na cijepljenim nego na necijepljenim biljkama. Promjer stabljike također je bio veći kod cijepljenih (1,29 cm) nego necijepljenih (1,06 cm) biljaka. Na vrijednost indeksa koncentracije klorofila (CCI) utjecali su N i cijepljenje. Kod necijepljenih biljaka s povećanjem koncentracije N značajno je povećana vrijednost CCI, dok kod cijepljenih biljaka koncentracija N nije utjecala na CCI. Na necijepljenim biljkama zabilježena je ranija pojava prve cvjetne grane nego na cijepljenim. Biljke tretirane sa 75 mgL^{-1} N ostvarile su veći rani prinos (1,25 t/0,1 ha) u usporedbi s ostala dva N tretmana, ali i značajno manju masu ploda (231 g) u odnosu na biljke tretirane sa 140 mgL^{-1} N (316 g). Cijepljenje je značajno utjecalo na vegetativni rast rajčice, ali ne i na sastavnice prinosa. Primjenom 75 mgL^{-1} N ostvaren je veći rani prinos dok je ukupni prinos povećan za gotovo 20% primjenom 140 mgL^{-1} N.

Ključne riječi: indeks koncentracije klorofila, koncentracija N, podloga Arnold, prinos, rajčica 'Belle F1'

The effects of nitrogen rate and grafting on tomato vegetative and generative traits

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Abstract

The present study aimed to determine the effect of nitrogen (N) rate reduction in nutrient solution and grafting on the vegetative and generative traits of tomato cv. 'Belle F1'. Plants, non-grafted or grafted onto the rootstock Arnold, were planted into rockwool slabs and then treated with three rates of N: 75, 140 and 205 mgL^{-1}. Two formed stems (main and lateral shoots) and five inflorescences were tomato cultivation characteristics. Plants treated with 140 mgL^{-1} N were higher and had more leaves than plants grown at 205 mgL^{-1} N. The leaf number of the lateral shoot was greater on the grafted than on non-grafted plants. The stem diameter in grafted plants (1.29 cm) was also higher compared with non-grafted plants (1.06 cm). The value of the chlorophyll concentration index (CCI) was influenced by N and grafting. An increase of N rate affected the increase of CCI in non-grafted plants, while in the grafted plants N rate did not affect CCI. The appearance of the first inflorescence was earlier recorded on non-grafted compared with grafted plants. Plants treated with 75 mgL^{-1} N had higher early yield (1.25 t / 0.1 ha) compared with two other N treatments. However, the fruit weight (231 g) on 75 mgL^{-1} N was lower compared with plants treated with 140 mgL^{-1} N (316 g). Grafting influenced on tomato vegetative growth, but not on yield components. The use of 75 mgL^{-1} N provided a higher early yield, while total yield increased by almost 20% using 140 mgL^{-1} N.

Key words: chlorophyll concentration index, grafting, nitrogen rate, rootstock Arnold, tomato cv. 'Belle F1', yield

The influence of biodegradable agent MineralTM on the fruit quality of tomato

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Abstract

The study was set up to identify the effects of biodegradable agent Mineral™ which is derived by natural process from sea, on quality parameters of tomato fruits. The experiment was conducted at the glasshouse on the laboratory field of the Biotechnical Faculty in Ljubljana. Three indeterminate hybrid varieties of grafted tomato: 'Gardel F1', 'Belle F1' and 'Novosadski jabučar' were tested. Plants were grown in two hydroponic systems: standard nutrient solution with Hoagland and Arnon and nutrient solution with Mineral™. The average pH value in the standard solution reached 6.2, and the value of EC reached 1.08 dS m^{-1}. Equivalent values in the Mineral™ solution were 8.3 and 1.6 dS m^{-1}. The plants that were irrigated with standard solution were statistically heavier, wider and higher. On the other hand, plants that were fertilized with Mineral™ had the higher fruits number. In the case of tomatoes irrigated with Mineral™, there were statistically higher contents of lutein, chlorophyll *a* and tocopherol. The level of chlorophyll *b* was the highest in 'Belle F1' (82.5 µg/g) on standard solution, and the highest levels of lutein and β-karoten were determined in 'Novosadski jabučar' also on standard solution. From these results it could be concluded that the influence of Mineral™ in comparison with the standard solution is negative on the growth and development of plants, but that it has positive influence on the content of some bioactive compounds.

Key words: *Lycopersicon esculentum*, nutrient solutions, hydroponic, fruit quality

Gnojidba i primjena arbuskularnih mikoriznih gljiva kao čimbenik prinosa i kvalitete ploda rajčice za preradu

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Sažetak

Industrijska rajčica ima visok afinitet prema simbiozi s arbuskularnim mikoriznim gljivama (AMG). Primjena mikoriznih gljiva tijekom proizvodnje presadnica, može biti inovativno i ekološki prihvatljivo rješenje za povećanje prinosa i kvalitete plodova industrijske rajčice. Cilj ovog rada bio je istražiti utjecaj primjene AMG (*Rhizophagus irregularis* and *Glomus mosseae*) na prinos, kvalitetu i sadržaj kalija (K) i kalcija (Ca) u plodu industrijske rajčice pri različitim gnojidbama. Pokus je postavljen kao split-plot dizajn s dva glavna faktora, gnojidbom (kontrola, NPK, organska, NPK+organska) i primjenom AMG (presadnice s ili bez primjene AMG-a) tijekom 2017. i 2018. godine. Prinos rajčice bio je značajno veći kod primjene NPK, organske i NPK+organske gnojidbe u odnosu na negnojenu kontrolu, dok primjena mikoriza nije imala utjecaja na prinos. Primjena AMG značajno je utjecala na povećanje koncentracije K i Ca u plodu rajčice. Nije bilo značajnih razlika između glavnih faktora i njihovih interakcija vezano uz kvalitetu ploda (likopen, suha tvar po Brixu, ukupni fenoli). Ipak, interakcija glavnih faktora pokazala je značajan utjecaj na hlapive spojeve arome što može imati pozitivan učinak na konzumiranje rajčice za preradu kao konzumne rajčice.

Ključne riječi: Terra rossa, *Lycopersicon esculentum*, *Rhizophagus irregularis, Glomus mosseae*

Fertilization and arbuscular mycorrhizae application as yield and processing tomato fruit quality factor

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Abstract

Processing tomato has a high affinity for the symbiosis with arbuscular mycorrhizal fungi (AMF). Mycorrhiza application, during seedlings production, may represent an innovative and sustainable solution to increase processing tomato yield and fruit quality. The objective of this study was to determine the effect of AMF (*Rhizophagus irregularis* and *Glomus mosseae*) application on processing tomato yield, fruit quality and potassium (K) and calcium (Ca) content under different fertilization regimes. Trial was set up as split plot design with two main factors, fertilization (Control, NPK, Organic, NPK+Organic) and AMF application (seedlings with or without AMF application) during 2017 and 2018. Tomato yield was significantly higher in NPK, Organic and NPK+Organic treatment compared to unfertilized Control, with no impact of mycorrhizae application. The AMF application had significantly increased fruit K and Ca concentration in tomato fruit. No significant differences were detected between selected main factors and their interactions regarding fruit quality parameters (lycopene, Brix, total phenols). Furthermore, main factor interaction has shown significant impact on tomato volatile compounds, which may have positive influence on consuming processing tomato as fresh tomato.

Key words: *Terra rossa*, *Lycopersicon esculentum*, *Rhizophagus irregularis*, *Glomus mosseae*

Uloga fitohormona u toleranciji kupusnjača na abiotski stres

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Sažetak

Globalno zagrijavanje i klimatske promjene imaju negativan utjecaj na proizvodnju usjeva na pogođenim područjima. Povećana slanost tla i suša su čimbenici abiotičkog stresa posebno izraženi u mediteranskim, polusušnim i sušnim klimatskim uvjetima. Tolerancija kupusnjača na čimbenike abiotičkog stresa regulirana je određenim biljnim hormonima kao što su salicilna kiselina (SA), apscizinska kiselina (ABA), auksini (IAA), citokiniini (CS) i brassinosteroidi (BR). Utjecaj solnog stresa i suše istražen je na odabranim kupusnjačama: kineskom kupusu (*Brassica rapa* ssp. *pekinensis*), bijelom kupusu (*B. oleracea* var. *capitata* forma *alba*) i raštici (*B. oleracea var. acephala*) s obzirom na ulogu biljnih hormona u toleranciji na abiotički stres. Na temelju fizioloških i biokemijskih markera, u primijenjenim eksperimentalnim uvjetima, kineski kupus je okarakteriziran kao osjetljiva vrsta, bijeli kupus kao umjereno tolerantna, a raštika tolerantna vrsta na sušu i solni stres.

Ključne riječi: Brassicaceae, suša, solni stres, tolerancija

The role of plant hormones in abiotic stress tolerance of selected *Brassicaceae*

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Abstract

Global warming and climate changes have enormous negative impact on crop production in affected areas. Increased soil salinity and drought are abiotic stresses particularly pronounced in Mediterranean, semi-arid, and arid climates. The abiotic stress tolerance of Brassica crops correlated with certain changes in plant hormones such as salicylic acid (SA), abscisic acid (ABA), auxins (IAA), cytokinins (CS) and brassinosteroids (BR). The effect of salinity stress and drought was evaluated on selected Brassica crops: Chinese cabbage (*Brassica rapa* ssp. *pekinensis*), white cabbage (*B. oleracea* var. *capitata* forma *alba*) and kale (*B. oleracea* var. *acephala*) with particular focus on the role of plant hormones in abiotic stress tolerance. Based on the physiological and biochemical markers the Chinese cabbage exhibited the lowest tolerance, followed by the white cabbage, while the kale appeared to be the most tolerant to drought and salinity stress in aplied experimental conditions.

Key words: Brassicaceae, drought, salinity stress, tolerance

Phytochemical characterization of bay laurel (*Laurus nobilis* L.) essential oils in Croatia

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Abstract

Within the research project entitled as "Taxonomy, Ecology and Utilization of Carob tree (*Ceratonia siliqua* L.) and Bay laurel (*Laurus nobilis* L.) in Croatia" acronym: TEUCLIC, grant number: IP-11-2013-3304-TEUCLIC, financed by Croatian Science Foundation, a phytochemical characterization of Bay laurel essential oils was studied in seven distinct populations of Croatian Adriatic region, such as: Lovran, Cres, Split, Hvar, Mljet, Dugi Otok and Žirje. The results of gas chromatography–mass spectrometry (GC-MS) analyses shows the highest content of 1,8-Cineole within the analysed samples of all populations, and its content vary between maximally 58.13 to minimally 38.94 %. Than follows linalool whose content vary between maximally 18.33 to minimally 1.99 %, terpinyl acetate, methyl eugenol, α-terpineol and terpinen-4-ol, β-pinen, etc. On the other hand, the content of myrcene is lower than 1 % and varies from only 0.26 % to maximally 0.69 %. Generally, the southern populations of Bay laurel have a higher content of the same components of essential oils in the comparison with the northern populations. However, the content of essential oils depends not just of geographic position of the population, but also of the season and date of leaves sampling.

Key words: Bay laurel, *Laurus nobilis*, essential oils, phytochemical chracterization

Metabolomički odgovor raštike (*Brassica oleracea* var. *acephala*) na stres izazvan niskim temperaturama

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Sažetak

Prema podacima Svjetske zdravstvene organizacije klimatske promjene značajno utječu na proizvodnju hrane širom svijeta, a taj trend se očekuje i u budućnosti. Jedan od primjera je i povećana proizvodnja kupusnjača iz skupine *Brassica oleracea* var. *acephala* u SAD-u posljednjih nekoliko godina. Kupusnače iz grupe *acephala* populariziraju se zbog svojih pozitivnih učinaka na zdravlje ljudi zbog prisutnosti specijaliziranih metabolita, ponajviše iz skupine glukozinolata, polifenola i karotenoida koji pak u biljci imaju važne uloge u interakciji biljaka i okoline. Cilj ovog rada bio je odrediti sastav metabolita u raštici izloženoj niskim temperaturama kako bi se objasnili mehanizmi otpornosti raštike na stres. Korištena su dva eksperimentalna postava: biljke uzgojene *in vitro* i uzgojene u zemlji. Nakon izlaganja stresu niskim temperaturama (+8 °C i -8 °C) određen je sastav specijaliziranih metabolita (iz skupine polifenola, glukozinolata te karotenoida) u usporedbi s kontrolom. Kao marker stresa korišten je prolin koji je pokazao značajno više vrijednosti kod biljaka izloženih hladnom stresu. Stres niskim temperaturama najviše je utjecao na razinu glukozinolata čija uloga u stresu će se dalje detaljnije istraživati.

Ključne riječi: raštika, specijalizirani metaboliti, niske temperature

Metabolomic response of kale (*Brassica oleracea* var. *acephala*) to low temperature stress

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Abstract

According to World Health Organization, climate change has a major impact on food production worldwide, and this trend will be even more pronounced in the future. One example is the increased production of *Brassica oleracea var acephala* in the United States in recent years. In last couple of years, vegetables from *acephala* group have been popularized as a food with positive effects on human health due to the presence of specialized metabolites from the glucosinolates, polyphenols and carotenoids groups, which in plants have important roles in interaction between plants and the environment. The aim of present work was to determine the composition of the metabolites in kale exposed to low temperatures in order to explain the mechanisms of stress resistance. Two experimental setups were used: *in vitro*-grown plants and plants grown in soil. After exposure to low temperature (+ 8 °C and -8 °C), the composition of specialized metabolites (from polyphenols, glucosinolates and carotenoids groups) was compared with the control. The levels of prolin significantly increase with the low temperature. Low temperature stress the most influenced glucosinolate level whose role in low temperature stress would be studied in the future.

Key words: kale, specialized metabolites, low temperature

Dinamika rasta i prinos rige u plutajućem hidroponu pod utjecajem solnog stresa

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Sažetak

Primjenom suvremene opreme za upravljanje abiotskim čimbenicima u hidroponskom uzgoju povrća u zaštićenim prostorima moguća je kontrola intenziteta stresa radi postizanja više nutritivne vrijednosti uz zadržavanje prinosa na prihvatljivoj razini. Istraživanje utjecaja solnog stresa u plutajućem hidroponu imalo je cilj utvrditi morfološka svojstva i prinos rige obzirom na povišenu EC-vrijednost postignutu dodavanjem natrij klorida (NaCl) standardnoj hranjivoj otopini (EC 3 $dS \cdot m^{-1}$, bez NaCl). Testirane su tri koncentracije NaCl-a (2,92, 5,27 i 7,62 $g \cdot L^{-1}$) u hranjivim otopinama s EC-vrijednostima 5, 7 i 9 $dS \cdot m^{-1}$. Najveći broj listova i masu rozete te duljinu najduljeg lista (4,8, 1,11 g i 19,5 cm) imala je riga uzgajana u standardnoj hranjivoj otopini, dok se povećanjem koncentracije NaCl-a njihove vrijednosti smanjuju do najmanjih (4,3, 0,83 g i 13,4 cm) pri EC 9 $dS \cdot m^{-1}$. Zbog veće relativne stope rasta (RSR) duljine lista, rast listova pri svim EC-vrijednostima hranjive otopine bio je brži na početku nego na kraju vegetacijskog razdoblja. Najveću RSR duljine lista na početku i kraju vegetacijskog razdoblja (0,17 i 0,09 $cm \cdot cm^{-1} \cdot dan$) imala je riga u standardnoj hranjivoj otopini, a najmanju (0,05 i 0,01 $cm \cdot cm^{-1} \cdot dan$) u hranjivoj otopini najveće EC-vrijednosti (9 $dS \cdot m^{-1}$). Relativno najveći prinos (2,77 $kg \cdot m^{-2}$) utvrđen je kod rige uzgajane bez dodatka NaCl-a, a najmanji (1,84 $kg \cdot m^{-2}$) kod rige iz hranive otopine s koncentracijom NaCl-a 5,27 $g \cdot L^{-1}$ (EC 7 $dS \cdot m^{-1}$).

Ključne riječi: *Eruca sativa*, natrij klorid, EC-vrijednost, relativna stopa rasta

Growth dynamics and yield of rocket in floating system as affected by salt stress

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Abstract

Using modern equipment for managing abiotic factors in hydroponic vegetable cultivation in greenhouses, it is possible to control stress intensity to achieve higher nutritional value along with the yield maintained at an acceptable level. The aim of salt stress effect in the floating system was to determine the morphological properties and the yield of the rocket with respect to the increased EC-value achieved by adding sodium chloride (NaCl) to the standard nutrient solution (EC 3 $dS \cdot m^{-1}$, without NaCl). Three concentrations of NaCl (2.92, 5.27 and 7.62 $g\ L^{-1}$) were tested in nutrient solutions with EC-values of 5, 7 and 9 $dS \cdot m^{-1}$. The largest number of leaves and rosette mass, also the length of the longest leaf (4.76, 1.11 and 19.5 cm) had rocket grown in standard nutrient solution, while increasing NaCl concentration decreased these values to the lowest (4.28, 0.83 g 13.4 cm) at EC 9 $dS \cdot m^{-1}$. Due to the higher relative growth rate (RSR) of the leaf length, leaf growth was faster at the beginning than at the end of the vegetation period at all tested nutrient solutions. The largest RSR of leaf length at the beginning and the end of the vegetation period (0.17 and 0.09 $cm \cdot cm^{-1}$ day) had a rocket in the standard nutrient solution and the smallest RSR (0.05 and 0.01 $cm\ cm^{-1} \cdot day$) was in the nutrient solution with the largest EC-values (9 $dS \cdot m^{-1}$). Also, the relatively highest yield (2.77 $kg \cdot m^{-2}$) was determined on rocket grown without the additionally NaCl and the lowest (1.84 $kg \cdot m^{-2}$) at nutrient solution with NaCl concentration of 5.27 $g \cdot L^{-1}$ (EC 7 $dS \cdot m^{-1}$).

Keywords: *Eruca sativa*, sodium chloride, EC-value, relative growth rate

Comparative genome analysis of *Trichoderma* species as agent of green mould on cultivated mushrooms

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Abstract

Certain species of the filamentous fungal genus *Trichoderma* - primarily *T. pleuroti*, *T. pleuroticola* responsible for the green mould disease of oyster mushroom (*Pleurotus ostreatus*), as well as *T. aggressivum* responsible for the green mould disease of button mushroom (*Agaricus bisporus*) - are causing series losses in the mushroom industry worldwide. In this research the whole genomes of these 3 species were sequenced and annotated to enable getting more insight into the development of green mould diseases. Sequencing was performed on Ion PGM™ platform. Following the assembly, genes were predicted using the Augustus software. Phylogenetic comparison was performed by using 100 neutrally evolving genes from reference genomes of 13 *Trichoderma* species and the 3 newly annotated *Trichoderma* gene sets. The phylogenetic analysis and the genome features support the closest relationship between the green mould-causing species and *T. harzianum*. The genomes contain numerous NRPS and PKS genes: among others, 14- and 18-residue peptaibol synthetases were characterized. Furthermore, the annotated genomes of the 3 green mould-causing *Trichoderma* species revealed some important features regarding the relationship between the species and their pathogenicities.

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Key words: *Trichoderma*, green mould, genome sequencing, peptaibol

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Prinosi krme i pojava korova u lucerni, smjesama s travama i esparzeti

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Sažetak

Na području istočne Hrvatske najvažniji usjev za proizvodnju sijena jest lucerna (*Medicago sativa* L.). Lucerna se tu u pravilu uzgaja kao čisti usjev, uz eventualno usijavanje talijanskog ljulja u predzadnjoj godini korištenja lucerišta s ciljem kompenziranja prorijeđenog sklopa lucerišta. Publikacije prethodnih istraživača izvan Hrvatske ukazuju da se smjese lucerne s travama brže suše uz manje gubitke, da se sporije zakorovljuju i da daju niže prinose krme u odnosu na čiste usjeve lucerne. Cilj istraživanja bio je usporediti proizvodnost i zakorovljenost čiste lucerne, smjesa lucerne s travama i čistog usjeva esparzete (*Onobrychis sativa* L.) u istočnoj Hrvatskoj. U poljskom pokusu u Tenji (2014.-2015.g.), suma prinosa prva dva otkosa čiste lucerne bila je slična sumama prinosa kod smjesa lucerne s travama (oko 10 tST/ha), a esparzeta je dala značajno manju sumu (4,7 tST/ha). Nakon prezimljenja, najmanja pojava korova ustanovljena je na smjesama lucerne s klupčastom oštricom i smjesama s povećanim sklopom trava, dok je najveća pojava korova bila u čistom usjevu esparzete. Unatoč pojavi korova nakon prezimljenja, u pokošenoj masi prvog i drugog porasta lucerne i njenih smjesa s travama nije ustanovljena mjerljiva masa korova, dok je u esparzeti ustanovljen udio korova u prinosu ST 50% u prvom otkosu i 31% u drugom otkosu. Projekcija godišnjeg prinosa je pokazala da bi čisti usjev lucerne bio najproduktivnija varijanta.

Ključne riječi: lucerna, smjese s travama, voluminozna krma, prinos, korovi

Forage yield and weed infestation of lucerne, lucerne-grass mixtures and sainfoin

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Abstract

In the area of eastern Croatia, the most important crop for hay production is lucerne (*Medicago sativa* L.). It is usually grown as a pure crop, with the possible inclusion of italian ryegrass in the last year of lucerne exploitation in order to compensate for the lucerne stand loss. The publications of previous researchers outside Croatia suggest that lucerne-grass mixtures dry faster to hay with fewer losses, come less weedy but yield lower yields compared to pure lucerne crops. The aim of the study was to compare the productivity and weed infestation of pure lucerne, its mixtures with grasses and pure sainfoin (*Onobrychis sativa* L.) in eastern Croatia. In the field trial in Tenja (2014-2015), the yield of the first two cuts of pure lucerne was similar to the yield of its mixtures with grasses (about 10 tDM/ha), but the sainfoin gave a significantly smaller yield (4.7 tDM/ha). Upon the overwintering, the smallest weed infestation was found in lucerne mixture with cocksfoot and in mixtures with increased grass density, while the largest weed infestation was in pure sainfoin. Despite the presence of weeds upon overwintering, there were not found measurable weed weights in the 1st and 2nd cut of the lucerne and its mixtures, while the share of weeds in the yield of sainfoin was 50% in the first cut and 31% in the second cut. The projection of annual yield has shown that pure lucerne crops would be the most productive option.

Key words: lucerne, grass mixtures, forage, yield, weed

Modificiranje pšeničnog škroba primjenom visokonaponskog električnog pražnjenja

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Sažetak

Pšenični škrob tretiran je primjenom visokonaponskom električnog pražnjenja (HVED), Na_2HPO_4, $Na_5P_3O_{10}$ i kombinacijom HVED sa svakom kemijskom modifikacijom. Nativnom i modificiranim škrobovima određena su svojstva želatinizacije (DSC), kapacitet bubrenja i indeks topljivosti te su pomoću SEM-a snimljene slike površina granula.

Rezultati su pokazali da HVED nema utjecaj na svojstva želatinizacije kada se koristi pojedinačno, ali utječe na svojstva želatinizacije kemijski modificiranih škrobova. Kapacitet bubrenja (KB) i indeks topljivosti (IT) povećavali su se s povećanjem temperature zagrijavanja, s izraženijim utjecajem temperature na HVED tretirani škrob u odnosu na nativni. Kemijske modifikacije povećale su KB i IT, dok je HVED tretman smanjio ove parametre kod kemijski modificiranih škrobova. SEM analiza pokazala je fizikalna oštećenja na površini granula uslijed HVED tretmana, i pojedinačno i u kombinaciji s kemijskim modifikacijama.

Ključne riječi: škrob pšenice, visokonaponsko električno pražnjenje (HVED), Na_2HPO_4, $Na_5P_3O_{10}$, fizikalna svojstva

Modification of wheat starch by high voltage electric discharge

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Abstract

Wheat starch was treated with high-voltage electric discharge (HVED), Na_2HPO_4, $Na_5P_3O_{10}$, and by combination of HVED with each chemical modification. Gelatinization properties (by DSC), swelling power and solubility were determined and images of starch granules were scanned by SEM. Results showed that HVED treatment did not influence gelatinization temperatures and enthalpy, but it did influence gelatinization temperatures of chemically modified starches, with more pronounced influence when used after chemical treatment. Swelling power (SP) and solubility (SOL) increased with increase of heating temperatures, with more pronounced effect of temperature on HVED treated starch in relation to native starch. Chemical modification increased SP and SOL, whereas HVED reduced SP and SOL of chemically modified starches. SEM analysis revealed physical damage of starch granules by HVED. HVED is promising tool in modification of starches, both individually and in combination with chemical modifications.

Key words: wheat starch, high-voltage electric discharge (HVED), Na_2HPO_4, $Na_5P_3O_{10}$, physical properties

Utjecaj folijarne gnojidbe na urod zrna suncokreta

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Sažetak

Folijarna gnojidba je dopunska gnojidba kojom se biljkama preko listova dodaju neophodna hraniva. Poseban značaj folijarne gnojidbe je u nepovoljnim uvjetima proizvodnje kada biljna hraniva nisu u pristupačnom obliku. S ciljem utvrđivanja utjecaja različitih folijarnih gnojiva na urod zrna, postavljen je poljski pokus u Osijeku prema slučajnom bloknom rasporedu, u tri ponavljanja. U istraživanju su bila tri hibrida suncokreta Poljoprivrednog instituta Osijek: Apolon, Luka i Matej. U tri tretmana su korištena folijarna gnojiva: Novalon 12-48-6+TE (T1-1), Novalon 20-20-20+TE (T2-1) i Novalon 15-5-35+TE (T3-1). U sljedeća tri tretmana (T1-2, T2-2 i T3-2), uz navedena folijarna gnojiva korišten je Bioplex, kompleksni biostimulator koji sadrži makro i mikro elemente (N, P, K, Ca, Mg, Fe, Zn, Mn, Cu) i različite tvari koje stimuliraju fiziološke procese u biljci. Statistički značajne razlike uroda zrna su utvrđene između hibrida ($P<0,01$), tretmana ($P<0,05$) i njihove interakcije ($P<0,01$). Najveći urod zrna je imao hibrid Matej (5,079 t/ha), a zatim Luka i Apolon. U odnosu na kontrolu (bez folijarne gnojidbe), sva tri tretmana uz dodatak Bioplexa (T1-2, T2-2 i T3-2) su imala veći urod zrna. Na osnovu rezultata preliminarnih istraživanja, primjenom folijarnih gnojiva i Bioplexa moguće je povećati urod zrna suncokreta.

Ključne riječi: suncokret, urod zrna, folijarna gnojidba, Novalon, Bioplex

Influence of foliar fertilization on the sunflower grain yield

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Abstract

Foliar fertilization is a supplemental fertilization which implies adding of necessary nutrients to the plants through the leaves. Particular importance of foliar fertilization is in unfavorable production conditions when plant nutrients are not in accessible form. In order to determine influence of different foliar fertilizers on grain yield, a field experiment was set up in Osijek according to random block design, in three repetitions. The research included three sunflower hybrids created at the Agricultural Institute Osijek: Apolon, Luka and Matej. In three treatments these foliar fertilizers were used: Novalon 12-48-6 + TE (T1-1), Novalon 20-20-20 + TE (T2-1) and Novalon 15-5-35 + TE (T3-1). In following three treatments (T1-2, T2-2 and T3-2), along with the mentioned foliar fertilizers was used Bioplex, a complex biostimulator containing macro and micro elements (N, P, K, Ca, Mg, Fe, Zn, Mn, Cu) and different substances that stimulate physiological processes in the plant. Statistically significant differences of grain yield were determined between hybrids ($P < 0.01$), treatments ($P < 0.05$) and their interaction ($P < 0.01$). Matej had the largest grain yield (5.079 t/ha), followed by Luka and Apolon. Furthermore, all three treatments with addition of Bioplex (T1-2, T2-2 and T3-2) had a higher grain yield than the control (without foliar fertilization). Based on the preliminary research results, foliar fertilizers and Bioplex application can increase sunflower grain yield.

Key words: sunflower, grain yield, foliar fertilization, Novalon, Bioplex

Prinos BC hibrida kukuruza u proizvodnim pokusima u 2018. godini

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Sažetak

U proizvodnoj 2018. g. obrađeno je 153 lokacije s prosječno osam BC hibrida kukuruza po lokaciji. Na većem broju lokacija u vrijeme optimalnog roka sjetve došlo je do isušivanja sjetvenog sloja tla što je za posljedicu imalo nejednoliko nicanje i redukciju sklopa. Kultivacija i prihrana obavljeni su u idealnim fazama što je pridonijelo snažnom razvoju kukuruza koji je u razvoju biljaka bio u vidljivoj prednosti 15-tak dana od prosjeka u zadnjim godinama. Pred cvatnju i u cvatnji zabilježeni su povoljni vremenski uvjeti što je rezultiralo potpunom oplodnjom. U kolovozu, kukuruz je bio u odličnoj kondiciji i sa solidnim zalihama vode u tlu. Tijekom kolovoza zabilježen duži period bez oborina, ali bez ekstremno visokih temperatura. Ovakvi uvjeti doveli su do bržeg dozrijevanja kukuruza, te ranije berbe, nižeg sadržaja vode u zrnu i odličnih prinosa. Rezultati obrađenih 1271 člana svih pokusa pokazuju prosječni prinos od 12,32 t/ha, prosječni sadržaj vode u zrnu pri berbi od 17,02% uz ostvarenje prosječnog sklopa od 66.260 biljaka/ha. Vidljivo je da vlage u berbi imaju pravilnu distribuciju rasta od ranijih prema kasnijim hibridima kukuruza. Što se tiče prinosa zrna zabilježeni su rekordni prinosi u svim grupama dozrijevanja. Vidljivu prednost po urodu pred hibridima u dugogodišnjoj proizvodnji ostvarili su BC hibridi FAO grupa 300, 400 i 500 (BC323, BC415, BC525) s ostvarenim prinosima: BC323 s 20,02 t/ha (Mursko Središće), BC525 s 17,40 t/ha (Voloder) i BC415 sa 16,19 t/ha (Klisa).

Ključne riječi: proizvodni pokusi, kukuruz, hibridi, prinos

BC maize hybrids yield in performance trials in 2018

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Abstract

During 2018, trials on 153 locations were processed with an average of eight BC hybrids per location. On a large number of locations, at the time of optimum planting time, there was a soil drainage which resulted by ununiform emergence and reduction in stands. Cultivation and fertilization were carried out at the ideal stages, which contributed to the strong development of maize, which plant development was in a visible advantage of 15 days from the average in the last years. Before and during flowering, favourable weather conditions were recorded, which resulted by complete fertilization. In August, the maize was in excellent condition and with solid water reserves in the soil. During the August there was a longer period of rainfall, but without extreme high temperatures. Such conditions have led to faster maize maturation, earlier harvest, lower grain moisture content and excellent yields. The results of the processed 1271 entries of all trials show an average yield of 12.32 t / ha, the average grain moisture at harvest of 17.02%, with an average plant density of 66.260 plants / ha. It is evident that moisture during harvest has a proper distribution of growth from earlier to later hybrids. Related to grain yields, record high yields were obtained in all FAO groups. New BC hybrids FAO 300, 400 and 500 (BC323, BC415, BC525) archived higher yield compared to the long-standing hybids. Obtained yields were as follows: BC323 20,02 t / ha (Mursko Središće), BC525 17,40 t / ha (Voloder) and BC415 16,19 t / ha (Klisa).

Keywords: production trials, maize, hybrids, yield

Rezultati primjene folijarnih gnojiva Profert Mara, Megagreen i Zeogreen na uljanoj repici

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Sažetak

U radu se iznose rezultati primjene folijarnih gnojiva (Profert Mara, Megagreen i Zeogreen) na tri sorte uljane repice u agroekološkim uvjetima sjeverozapadne Hrvatske. Istraživanje je provedeno kroz poljski pokus postavljen na eutrično smeđem antropogeniziranom tlu u Zagrebu tijekom 2016./2017. godine prema split blok metodi u pet ponavljanja. Istraživano je pet tretmana prihrane: 1) Kontrola - KAN (54 kg ha^{-1} N u prvoj + 33,75 kg ha^{-1} N u drugoj prihrani; 2) KAN (54 kg ha^{-1} N u prvoj prihrani) + Profert Mara 10 l ha^{-1} + Megagreen 2,5 kg ha^{-1} (prvo tretiranje) + Profert Mara 10 l ha^{-1} + Zeogreen 2,5 kg ha^{-1} (drugo tretiranje nakon 10 dana); 3) Profert Mara 10 l ha^{-1} + Megagreen 2,5 kg ha^{-1} (tretiranje u jesen) + Profert Mara 10 l ha^{-1} + Megagreen 2,5 kg ha^{-1} (dva tretiranja u razmaku od 10 dana u proljeće); 4) Profert Mara 10 l ha^{-1} + Megagreen 2,5 kg ha^{-1} (dva tretiranja u razmaku od 10 dana u proljeće); 5) Profert Mara 10 l ha^{-1} + Megagreen 2,5 kg ha^{-1} (prvo tretiranje) + Profert Mara 10 l ha^{-1} + Zeogreen 2,5 kg ha^{-1} (drugo tretiranje nakon 10 dana). na tri sorte uljane repice (PT 234, PX 113 i Ametyst), uz prethodnu osnovnu gnojidbu na svim varijantama s 800 kg ha^{-1} NPK 7:20:30.

Hibridne sorte PT 234 i PX 113 ostvarile su značajno veći prinos sjemena i ulja u odnosu na linijsku sortu Ametyst. Folijarna primjena gnojiva Profert Mara, Megagreen i Zeogreen nije rezultirala promjenom prinosa sjemena i ulja u odnosu na uobičajnu prihranu KAN-om (54 + 33,75 kg ha^{-1} N). Međutim, folijarna primjena nekih kombinacija istraživanih gnojiva može povećati prinos ulja kod sorte Ametyst, što je potrebno provjeriti kroz višegodišnja istraživanja.

Ključne riječi: uljana repica, folijarna gnojiva, prinos, sastavnice prinosa

Results of application of foliar fertilizers Profert Mara, Megagreen and Zeogreen on rapeseed

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Abstract

The paper presents the results of the application of foliar fertilizers (Profert Mara, Megagreen and Zeogreen) upon the three rapeseed varieties in agroecological conditions of northwestern Croatia. The research was conducted through a field experiment which was set up on eutrophic brown anthropogenised soil in Zagreb during 2016/2017 year according to split block method with five replications. Five topdressing treatments were investigated: 1) Control - KAN (54 kg ha^{-1} N in the first one + 33.75 kg ha^{-1} N in second topdressing; 2) KAN (54 kg ha^{-1} N in the first topdressing) + Profert Mara 10 l ha^{-1} + Megagreen 2.5 kg ha^{-1} (first treatment) + Profert Mara 10 l ha^{-1} + Zeogreen 2.5 kg ha^{-1} (second treatment after 10 days); 3) Profert Mara 10 l ha^{-1} + Megagreen 2.5 kg ha^{-1} (treatment in autumn) + Profert Mara 10 l ha^{-1} + Megagreen 2.5 kg ha^{-1} (two treatments at intervals of 10 days in spring); 4) Profert Mara 10 l ha^{-1} + Megagreen 2.5 kg ha^{-1} (two treatments at intervals of 10 days in spring); 5) Profert Mara 10 l ha^{-1} + Megagreen 2.5 kg ha^{-1} (first treatment) + Profert Mara 10 l ha^{-1} + Zeogreen 2.5 kg ha^{-1} (second application after 10 days) at three varieties of rapeseed (PT 234, PX 113 and Ametyst), with the previous basic fertilization in all variants with 800 kg ha^{-1} NPK 7:20:30.

The hybrid varieties PT 234 and PX 113 had a significantly higher seed and oil yield compared to line cultivar Ametyst. Foliar application with fertilizers Profert Mara, Megagreen and Zeogreen did not result with significant changes in the seed and oil yield compared to the regular topdressing with KAN (54 + 33.75 kg ha^{-1} N). However, the foliar application of some combinations of researched fertilizers can increase the oil yield of the cultivar Ametyst, which should be examined through multi-year research.

Key words: rapeseed, foliar fertilizers, yield, yield components

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Zbornik sažetaka

Ribarstvo, lovstvo i pčelarstvo

Biochemical profile of cultured and wild-caught turbot *Scophthalmus maximus* (Linnaeus, 1758) from northern Adriatic Sea

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Abstract

Biochemical blood analysis provides significant information about the physiological status of fish and their response depends on living conditions. The aim of this study was to determine the variation of blood biochemical parameters of cultured and wild-caught turbot from the Adriatic Sea in spring when the values of water temperature are the most favorable for this fish species. The levels of total protein, triglycerides, bilirubin, creatine kinase, albumin and globulin were significantly higher in the group of cultured turbot. The higher levels of measured parameters are most likely consequence of high availability of feed and limitation within rearing space and density. There were no significant differences in albumin/globulin ratio (A/G) between the two groups. In addition, we measured changes in the activity of antioxidant enzymes superoxide dismutase (SOD) and glutathione peroxidase (GSH-Px) between the two groups. The concentration of SOD was higher in the cultured group while the concentration of GSH-Px was higher in the wild-caught group. Calcium and phosphorus concentrations were higher in wild-caught group. Glucose and cholesterol were also higher in wild-caught turbot. In relation to the needs for further aquaculture development of turbot, knowledge on biological responses of this species to environmental changes are vital for understanding the correlation of living conditions to biochemical parameters which, in this study, showed the significant difference between the two groups.

Key words: turbot, biochemical parameters, living conditions, stress, aquaculture

Biochemical properties of *Pecten jacobaeus* (Linnaeus, 1758) tissues over yearly seasons

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Abstract

Mediterranean scallop (*Pecten jacobaeus* L.) is commercially exploited in the Northern Adriatic. The aim of this study was to determine the biochemical properties of the tissues (muscle, gills, gonad and hepatopancreas) during yearly seasons defined by the sea temperature. Concentrations of Ca, Mg, cholesterol (CHOL), glucose (GLU) and triglycerides (TRIG) were analyzed. The concentration of measured properties varied between the investigated tissues and between seasons. Ca and Mg levels were the highest in summer and winter in gonad (Ca, Mg) and hepatopancreas (Ca). Tissue concentrations of CHOL, GLU and TRIG were not uniform in tissues or seasons: levels of GLU were elevated in gonadal tissue in the summer and in hepatopancreas in the fall. TRIG levels varied in gonad and hepatopancreas tissues in comparison to other tissues, while CHOL was significantly higher in gonad (autumn) and hepatopancreas (winter). Scallops under study have shown the maximum muscle energy reserves correlate with the maximum autumn gonadosomatic index. Although their nutritional reserves, according to the literature, are primarily stored in muscle and hepatopancreas, this study found that levels of CHOL, GLU and TRIG were the highest in hepatopancreas and gonad. The study thus confirmed the influence of seasons on the levels of biochemical properties which are relevant for ionic homeostasis, reproduction control, catabolism of protein and energy reserves.

Keywords: *Pecten jacobaeus*, biochemical properties, tissues, seasons

Fish sperm as *in vitro* toxicology test system

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Abstract

In vitro test systems have been widely used in ecotoxicology in the last decades and fish sperm can be a feasible *in vitro* model. Zebrafish and common carp are specified in OECD guidelines as suitable model species in ecotoxicology, however, analysis of sperm is not mentioned in any of the standard protocols. Our goal was to develop *in vitro* toxicology test system based on analysis of zebrafish and common carp sperm.

Zebrafish sperm was stripped and pooled from different males, whereas in carp, individual samples were used. The sperm was exposed to different heavy metals (Cr, Zn, Cd, Ni, Cu, Hg, As). The exposure duration was 4 hours and the motility parameters were assessed every 30 minutes of the exposure. Progressive motility of sperm proved to be the most sensitive to the *in vitro* toxic exposure: it reacted with dose- and time-response in case of each examined heavy metals. Heavy metals, except for As, affected the motility parameters in the same range of concentrations in the two species. Fish sperm is a reliable *in vitro* toxicology model; it can be an accurate, fast bioindicator of aquatic pollutions. Thereby its application should be considered with respect to environmental and animal protection.

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Key words: zebrafish, common carp, sperm, Computer-assisted sperm analysis (CASA), heavy metals

Morfometrijska obilježja prepelice pućpure (*Coturnix coturnix* L.) na Duvanjskom polju

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Sažetak

Prepelica pućpura (*Coturnix coturnix* L.) je najmanja europska vrsta selica iz porodice (*Phasianidae*), koja od početka proljeća pa do kraja jeseni naseljava prostor Srednje i Jugoistočne Europe te se smatra izrazito atraktivnom lovnom vrstom. Istraživanje je provedeno na području Duvanjskog polja (jugozapadna Bosna i Hercegovina) te je odstrjelom u skupnim lovovima prikupljeno 50 jedinki u razdoblju od 15.08. do 15.09. 2015. godine. Svakoj jedinki je temeljem obojanosti perja utvrđen spol te izmjerena masa, a potom je izmjereno i 8 morfometrijskih mjera (raspon krila, širina glave, duljina glave, duljina trupa, duljina krila, duljina repa, duljina kljuna i duljina tarzusa) koje su statistički obrađene. Rezultati T-testa morfometrijskih mjera ukazuju na nepostojanje statistički značajne razlike između spolova prepelice pućpure, što se podudara i sa uspoređivanom znanstvenom i stručnom literaturom.

Ključne riječi: prepelica pućpura, *Coturnix coturnix*, morfometrija, Duvanjsko polje

Morphometric characteristics of common quail (*Coturnix coturnix* L.) on Duvno field

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Abstract

Common quail (*Coturnix coturnix* L.) is the smallest European migratory species from the Phasianidae family, which from early spring to late autumn inhabits area of Central and Southeast Europe and is considered extremely attractive hunting species. The research was conducted in the area of Duvno field (southwestern Bosnia and Herzegovina) where 50 individuals were harvested and collected during group hunts in the period from 15.08. till 15.09. 2015. For each individual sex was based on the colouring of feathers, mass and 8 morphometric measures (wingspan, head width, head length, body length, wing length, tail length, beak length and the length of tarsus) were measured and statistically processed. The results of the T-test of morphometric measures indicate that there is no statistically significant difference between the sexes of the common quail, which also coincides with the comparative scientific literature.

Key words: Common quail, *Coturnix coturnix*, morphometry, Duvno field

Applicability of an African catfish (*Clarias gariepinus*) sex specific DNA marker

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Abstract

The applicability of an African catfish (*Clarias gariepinus*) sex specific DNA marker was investigated. One F1 (179 individuals) and three F2 families (85, 92, and 89 individuals respectively) were examined. All four F1 generations were produced by a single-pair cross, while for the three F2 generations full-sib crossing was carried out. The P0 breeders were originated from 5 different broodstocks. The F1 group was sexed by the molecular marker 3-5 weeks after propagation and was subsequently reared in separated male and female groups. The phenotypic sex was identified by aceto-carmine squash method at juvenile age. The three F2 families were bred in mixed-sex groups and gender differentiation was performed according to the sexually dimorphic traits on mature specimens. By comparing the phenotype with the data from molecular sexing, the latter was found to predict phenotypic sex with 97.04 % accuracy. The recombination rate between the sex determining locus and the sex specific marker was 1.176 %, 4.598 %, and 2.247 % in the three F2 crosses and 3,352 % in the F1 family. The calculated average genetic distance between the two loci is 2.955 cM, indicating strong linkage, and, thereby a widespread applicability of the African catfish sex specific marker in aquaculture.

This work was supported by OTKA (105393), iFishIENCi (H2020-DT-BG-04-2018) and GINOP-2.1.2-8-1-4-16-2017-00090 projects.

Key words: African catfish, sex determination, sex specific marker

A novel multiplex microsatellite set and its application on common carp (*Cyprinus carpio*)

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Abstract

The need for a comparable genetic analysis of different common carp (*Cyprinus carpio*) stocks is increasing nowadays due to high demand for genetic breeding. However, no proper, cost-efficient, and rapidly applicable multiplex microsatellite set is available at the moment for automatic evaluation of data, therefore, a new multiplex set was developed. Tetranucleotide microsatellites were examined in the available common carp genome with in silico analysis. Primers were designed for the flanking region of the detected 64000 microsatellites. The number of potential markers was restricted to 54 by the annealing temperature, specificity, primer-dimer formation and genomic location of the primers. The markers were optimized individually and their polymorphism was checked by fragment analysis. Four different pentaplex sets were assembled from the most congruous markers designed with four different fluorescent primers (PET, VIC, NED, FAM) suitable for simultaneous fragment analysis. The applicability of this multiplex set was studied on two Hungarian common carp populations, each with 16 specimens and data was evaluated by the R software. According to the preliminary data, the allele number ranged from 2 to 15 with a mean of 4.25. The average richness of the alleles for each locus was 0.281 (Simpson Index, 1-D) with an evenness of 0.524. In conclusion, this novel multiplex microsatellite set is a powerful tool for fast and cost-effective analysis of both natural and farmed populations of common carp.

The work was supported by the GINOP-2.3.2-15-2016-00004 and the EFOP-3.6.3-VEKOP-16-2017-00008 projects. The project is co-financed by the European Union and the European Social Fund.

Key words: multiplex PCR, microsatellites, common carp, population genetics

Preliminarni rezultati ispitivanja novog dizajna vrše za lov škampa

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Sažetak

Gospodarski ribolov škampa *Nephrops norvegicus* obavlja se upotrebom pridnene povlačne mreže koće i vrše. Većinski dio ulova ostvaruje koća, koja ribolov obavlja na otvorenom moru i kanalskim područjima, dok vrša izlovljava manji dio i to isključivo u kanalskim područjima. Vrša se po efikasnosti ne može uspoređivati s koćom, ali je interesantna zbog toga što, za razliku od koće, izlovljava gotovo isključivo velikog škampa. Mogući razlog male lovnosti vrše, u usporedbi s koćom, može biti taj što škamp teško pronalazi ulaz u vršu. U tu svrhu dizajnirana je vrša sa šest vršnjaka te je njena lovnost uspoređena s komercijalnom vršom s dva vršnjaka u proljeće 2018. godine na području Bračkog i Hvarskog kanala. Preliminarni rezultati pokazuju da standardna vrša lovi prosječno 4,39 ± 2,88 jedinki po parangalu, dok vrša novog dizajna lovi prosječno 3,73 ± 2,71 jedinki po parangalu. Nije utvrđena statistički značajna razlika u ulovu između dva dizajna vrše.

Ključne riječi: škamp, *Nephrops norvegicus*, dizajn vrše, ribarstvo

A new creel design for *Nephrops* fishery: preliminary results

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Abstract

Norway lobster (*Nephrops norvegicus*) is commercially exploited by bottom trawls and creels. In the Adriatic Sea, Norway lobster is predominantly caught by bottom trawls, both on the open sea and in channel areas, while a smaller portion is caught by creels operating in the channel areas. Although creels have low fishing efficiency compared to bottom trawls, their advantage is that they catch almost exclusively large Norway lobster specimens, with higher market value. One possible reason for the low fishing efficiency of the creels is that Norway lobster has difficulties finding the entrance into the creel. In order to test this, a creel with six entrances was designed and its catchability was compared with commercial creels in spring 2018 in Brač and Hvar Channels. Preliminary results showed that the average number of Norway lobsters caught per longline with the standard creel design was 4.39 ± 2.88, while the new creel design caught 3.73 ± 2.71 individuals per longline. There was no significant difference in catchability between the two creel designs.

Key words: Norway lobster, *Nephrops norvegicus*, creel design, fishery

Brojno stanje i obilježja uzgoja hrvatskih lovačkih pasmina pasa u Republici Hrvatskoj

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Sažetak

U Republici Hrvatskoj evidentirano je 7 autohtonih pasmina pasa od kojih se tri pasmine (posavski gonič, istarski kratkodlaki gonič i istarski oštrodlaki gonič) koriste u lovu. U radu je analizirano stanje uzgoja i naznačena obilježja hrvatskih lovačkih pasmina pasa u Republici Hrvatskoj u proteklih 5 godina (2013. - 2017.). Podaci o uzgoju dobiveni su iz popisa prijavljenih legla Hrvatskog kinološkog saveza. U svrhu analize, podaci su razvrstani prema godinama, regijama, županijama, pasminama i spolu. U istraživanom razdoblju, ukupno je oštenjeno 9007 štenadi. Analizom podataka uočen je pad broja uzgojenih štenaca svih triju pasmina u promatranom razdoblju. Istarski kratkodlaki gonič bilježi pad broja uzgojenih štenaca za 5,5%, posavski gonič za 14,8%, dok je najveći pad zabilježen kod istarskog oštrodlakog goniča za čak 54%. Važnost uzgoja ovih pasmina je višestruka, prvenstveno jer su hrvatska nacionalna baština, kinološko naslijeđe i kulturno bogatstvo, a zbog svojih radnih osobina imaju vrlo veliku vrijednost u lovu. Zbog svega navedenog, važno je pronaći načine i metode kojima bi se uzgajatelje potaklo na povećanje uzgoja ovih pasmina u Hrvatskoj. Na osnovu prikupljenih podataka i analize rezultata moguće je predložiti smjernice za unapređenje uzgoja i očuvanje hrvatskih autohtonih lovačkih pasmina pasa. Zbog drastičnog opadanja broja uzgojenih štenaca istarskog oštrodlakog goniča u promatranom razdoblju, poseban naglasak bi se trebao staviti na poticanje uzgoja ove pasmine.

Ključne riječi: stanje uzgoja, hrvatske pasmine pasa

Quantity and characteristics of Croatian breeding hunting dogs in the Republic of Croatia

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Abstract

The Republic of Croatia has 7 autochthonous dog breeds , three of which (Posavatz Hound, Istrian short-haired Hound and Istrian wire-haired Hound) are used for hunting. The paper analyzes the state and characteristics of breeding of Croatian hound dogs in the Republic of Croatia over the past 5 years (2013 - 2017), which will help to develop guidelines for further breeding and preservation of the National Kinological Treasury. Breeding data were obtained from the list of registered litter of the Croatian Keno Association. For the purposes of analysis, data are classified by age, region, county, breed and sex. During the research period, 9007 puppies were delivered. Based on data analysis it is observed that number of puppies are declining. The Istrian short-haired puppies recorded a drop in the number of pups by 5.5%, Posavatz Hound by 14.8%, while the largest decline was recorded for the Istrian wire-haired Hound as much as 54%. The importance of breeding of these breeds is multifaceted. Primarily because of Croatian national heritage, and then due to kinological heritage and cultural wealth. Because of their working characteristics, they have a very high value in hunting as such. Because of all this, it is important to find instruments to encourage breeders in Croatia to increase the breeding of these breeds in Croatia. Due to drastic decline of Istrian wire-haired hound dog puppies within the analyzed period special emphasis should be put on encouraging breeders of this breed.

Key words: breeding conditions, croatian breeding hounds

Kvantificiranje zaglavljivanja u vršama za lov škampa (*Nephrops norvegicus*)

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Sažetak

Zaglavljivanje (inćetavanje) riba u mrežni teg ribarskih alata može otežati obavljanje ribolova te smanjiti njegovu učinkovitost, a time i ekonomsku isplativost. Vjerojatnost zaglavljivanja se do sada nije službeno kvantificiralo tijekom određivanja selektivnosti ribolovnih alata. U ovoj studiji razvijena je nova metoda određivanja selektivnosti koja uključuje i određivanje vjerojatnosti zaglavljivanja te je upotrijebljena kod određivanja selektivnosti vrša za lov škampa (*Nephrops norvegicus*) i vabića (*Squilla mantis*). Za razliku od standardnog pristupa koji uključuje određivanje vjerojatnosti dvaju mogućih ishoda: jedinka je zadržana u vrši i jedinka je pobjegla iz vrše, novom metodom određuje se vjerojatnost triju mogućih ishoda: jedinka je zadržana unutar vrše, jedinka je zadržana zaglavljivanjem u oko vrše i jedinka je pobjegla iz vrše. Za vabića je određena maksimalna vjerojatnost zaglavljivanja od 13,5% kod duljine karapaksa 32,5 mm. Za istu duljinu karapaksa, 63,1% vabića ulovljeno je u vrši, dok je 23,4% jedinki pobjeglo iz vrše. Za škampa je određena maksimalna vjerojatnost zaglavljivanja od 2% i to kod duljine karapaksa od 34,0 mm. Novorazvijenu metodu moguće je prilagoditi te dalje istražiti njenu potencijalnu uporabu pri određivanju selektivnosti lova drugih vrsta i alata.

Ključne riječi: Škamp, vabić, zaglavljivanje, vrše, selektivnost

Quantifying sticking probability in Norway lobster (*Nephrops norvegicus*) creel fishery

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Abstract

Fish stuck in the fishing gear meshes can lead to operational problems in some fisheries, affecting the economic gain. However, mesh sticking probability has never been formally quantified in the estimation of fishing gear size selectivity. Unlike the standard methods used to estimate creel size selectivity, the novel method developed enables separate quantification of the: probability of retention inside the creel, probability of sticking in the creel meshes and probability of escapement from the test creels. The novel method was applied to mantis shrimp (*Squilla mantis*) and Norway lobster (*Nephrops norvegicus*) in the creel fishery. The curve that described mesh sticking probability was bell-shaped, with a maximum value for a specific carapace length and decreasing probabilities for both smaller and larger individuals. For mantis shrimp, the maximum sticking probability (13.5%) corresponded to 32.5 mm carapace length, while 63.1% of individuals of that size were retained inside the creels and 23.4% escaped. For Norway lobster the maximum sticking probability was 2.0%, corresponding to 34.0 mm carapace length. The novel method could be adapted and further explored for its potential use in determining the fishing selectivity of other species and tools.

Key words: Norway lobster, mantis shrimp, sticking, creels, selectivity

Svojstva zajednica sive pčele (*Apis mellifera carnica*) u field uvjetima tijekom dva desetljeća

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Sažetak

Selekcija pčela često se smatra jednim od najsloženijih postupaka u pčelarstvu, a dijelom proizlazi iz složene biologije parenja te razvoja trutova partenogenezom, koji su posljedično haploidi. Zajednice se u procesu selekcije ocjenjuju i odabiru u svakoj generaciji prema poželjnim svojstvima, a najbolje se koriste za roditelje slijedeće generacije. Kontrolirani uzgoj matica sive pčele (*Apis mellifera carnica*) primjenom metoda selekcije u Hrvatskoj započeo je u posljednjem desetljeću XX stoljeća. Testiranje svojstava organizira se u odgovarajućim lokalnim uvjetima distribucijom matica iz istog uzgoja na pčelinjake drugih uzgajivača matica ili pčelara koji su prihvatili sudjelovanje u provedbi uzgojnog programa (*field* test). Zajednice s testnim maticama ocjenjuju se na svojstva ponašanja (mirnoća na saću, obrambeno ponašanje, rojivost) te na prinos meda. Za izračun su korišteni podaci za 1570 pčelinjih zajednica iz baze Hrvatske poljoprivredne agencije, testiranih u razdoblju od 2000. do 2017. godine. Izračunati koeficijenti regresije (R^2) za mirnoću, obrambeno ponašanje i rojivost (0,07; 0,03 i 0,06) ukazuju na pozitivan utjecaj selekcijskih postupaka na svojstva ponašanja, dok isti nije utvrđen za prinose meda (R^2=0,002) u praćenom razdoblju.

Ključne riječi: siva pčela, *Apis mellifera carnica*, *field* test, svojstva ponašanja, prinosi, trend

Colony traits of Carniolan honey bees (*Apis mellifera carnica*) in field conditions over two decades

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Abstract

Honey bee selection is often considered to be one of the most complicated procedures in beekeeping, partly due to the complex mating biology and the parthenogenetic development of drones, which are consequently haploids. Honeybee colonies are evaluated in the selection process and selected in each generation according to desirable traits. The best are used for parents of the next generation. Controlled breeding of Carniolan (*Apis mellifera carnica*) honey bee queens using the selection methods in Croatia started in the last decade of the 20th century. Testing of colony performance is implemented under representative local conditions. Test queens from each source are distributed to test apiary of another queen breeder or beekeeper who accepted participation in the implementation of the breeding program (field test). Honey bee queens are evaluated on behavioural characteristics (calmness on the combs, defensive behaviour, swarming ability) and honey yield. For the analysis were used data for 1570 honey bee colonies tested in the period from 2000 to 2017 from the Croatian Agricultural Agency database. Calculated regression coefficients (R2) for calmness on the combs, defensive behaviour and swarming ability (0.07, 0.03 and 0.06) indicate the positive effect of selection procedures on behavioural traits, while the effect was not found for honey yields (R2 = 0.002) in the observed period.

Key words: Carniolan bees, *Apis mellifera carnica*, field test, behavioural traits, honey yields, trend

Rewilding u Hrvatskoj

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Sažetak

Rewilding se promovira kao ambiciozna nadogradnja trenutnim pristupima očuvanja prirode. Povećano je zanimanje za *rewilding* u popularnim i znanstvenim krugovima, predmet je rasprava, nadmašujući znanstvena istraživanja i konzervatorsku praksu. Pojam *rewilding* osmišljen je sredinom 1990-ih od strane američkih konzervatorskih biologa. Predstavili su *rewilding* kao znanstvenu strategiju, fokusiranu na osiguravanje i povezivanje velikih područja i ispuštanje ciljanih divljih životinja kao što su vukovi. Uskoro se pojam *rewilding* povezuje s inicijativama očuvanja koje eksplicitno nastoje vratiti nedostajuće ili nefunkcionalne procese ekosustava, često kroz reintrodukciju „funkcionalnih" vrsta. Projekti i istraživanja provode se diljem svijeta, ponajviše u Europi i Sjevernoj Americi. Zajednički im je cilj održati ili povećati biološku raznolikost, istovremeno smanjujući utjecaj prisutnih i prošlih ljudskih intervencija kroz obnovu vrsta i ekoloških procesa. Projekt *Rewilding* Velebit provodi se na planini Velebit u Hrvatskoj od 2011. godine, u uskoj suradnji i partnerstvu s *Rewilding* Europe-om. Glavne aktivnosti su jačanje i zaštita izvornih prirodnih procesa, kao što su prirodna obnova šuma i prirodna ispaša. Provodi se unutar *rewilding* principa kako bi se smanjila fragmentacija staništa, s krajnjim ciljem postizanja stanja ekosustava u kojem je pasivno upravljanje dostatno te je smanjena ljudska uključenost, uz održavanje optimalne funkcionalnosti ekosustava i biološke raznolikosti.

Ključne riječi: *rewilding*, Hrvatska, Velebit

Rewilding in Croatia

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Abstract

Rewilding is being promoted as an ambitious upgrade to current approaches to nature conservation. Interest is growing in popular and scientific literatures, and *rewilding* is the subject of significant comment and debate, outstripping scientific research and conservation practice. The term *rewilding* was coined in the mid-1990's by a group of US conservation biologists. They presented *rewilding* as the scientific strategy, focusing on securing and connecting large areas and releasing functional species such as wolves. Soon, the term *rewilding* has been associated with conservation initiatives that explicitly seek to restore missing or dysfunctional ecosystem processes, often trough the reintroduction of "functional" species. Projects and research are found the world over, with concentrations in Europe and North America. A common aim is to maintain, or increase, biodiversity, while reducing the impact of present and past human interventions through the restoration of species and ecological processes. *Rewilding* Velebit project is implemented on the Velebit mountain in Croatia since 2011, in close cooperation and under partnership with *Rewilding* Europe. Main activities are boosting and protection of the original natural processes, like natural forest regeneration and natural grazing. Within the key *rewilding* cores and their linkage to reduce the fragmentation of the habitat, with the ultimate goal of achieving the state of the ecosystem in which passive management is sufficient and human involvement minimized, while maintaining optimal functionality of ecosystems and biodiversity.

Key words: *rewilding*, Croatia, Velebit

Lovno gospodarenje u okviru novog Zakona o lovstvu

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Sažetak

U službenom glasniku Republike Hrvatske "Narodnim novinama" broj 99/2018 objavljen je novi Zakon o lovstvu. Jedan od razloga donošenja novoga Zakona je usklađivanje s Direktivom o očuvanju divljih ptica odnosno direktivama u području okoliša. Nadalje, s popisa divljači uklonjen je mali indijski mungos (*Herpestes ishneumonum* L.) koji se smatra invazivnim na području Europske unije. Donošenjem ovog Zakona mijenjaju se uvjeti kod davanja državnih lovišta u koncesiju na rok do 30 godina, a a koja bi podrazumijevala samo veća i gospodarski perspektivnija lovišta. Jedna od novih mjera propisuje da u državnom i privatnom lovištu lovnogospodarsku osnovu odobrava nadležno Ministarstvo, a nadležna Županija odobrava osnovu za zajednička lovišta. Ovim Zakonom u hrvatsko lovstvo se ponovo uvodi pojam „lovnika" tj. osobe odgovorne za provedbu lova. Nadalje, novim Zakonom vlasnicima privatnih zemljišta površine do 500 ha omogućuje se osnivanje privatnog lovišta na predmetnoj površini. Kao jedna od bitnijih mjera koja se ovim Zakonom uređuje je sprječavanje šteta od divljači, kako na poljoprivrednim površinama, tako i u prometu, pri čemu su ovi problemi jasnije i preciznije uređeni, a sve subjekte u predmetnim postupcima nastojalo se staviti u ravnopravniji položaj s jasnije određenim pravima i obvezama. Zakonodavac je ovim Zakonom nastojao unaprijediti uzgoj, zaštitu, lov i korištenje divljači, prema načelu očuvanja i zaštite prirode s ciljem očuvanja i zaštite divljači i njenih prirodnih staništa kao nacionalnog bogatstva. Isto tako, Zakonom se nastoji unaprijediti lovstvo kao gospodarski značajnu djelatnost te značajnije povezati s djelatnostima u području poljoprivrede, šumarstva, turizma, trgovine i dr.

Ključne riječi: divljač, lov, lovstvo, uzgoj, zaštita

Hunting management within the new hunting law

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Abstract

In the official gazete "Narodne novine" no. 99/2018 a new Hunting Law was published for the Republic of Croatia. One of the reasons for the adoption of the new Act is alignment with the Wild Birds Directive, directives on nature and environment. Furthermore, a small Indian mungos (*Herpestes ishneumon* L.), which is considered invasive in the European Union, was removed from the game list. By adopting this Law, the conditions for granting concessions to state hunting grounds will be changed. Only larger and economically prospective hunting areas will be available for 30 year concessions. What's new is that for the state and private hunting grounds the hunting management plan will be approved by the competent Ministry and for the union hunting grounds the hunting management plan will be approved by county authorities. This Law introduces the concept of "a professional hunter", a person responsible for hunting. Furthermore, the new Act allows owners of private land up to 500 hectares to set up a private hunting ground on the surface. As one of the most important measures regulated by this Act is to prevent damaging game, both in agricultural areas and in traffic where these problems are clarified and more precisely regulated, and all subjects in the concerned proceedings were to be placed in a more equal position with more specific rights and obligations. Through this Act, the legislator's intention is to improve breeding, protection and hunting on the principle of preservation of game and its natural habitats as national wealth. Likewise, the Act seeks to improve hunting as an economically significant activity and to be more closely associated with activities in the fields of agriculture, forestry, tourism, trade and others.

Key words: breeding, game, hunt, hunting management, protection

GOODFISH – A project for the development of Hungarian aquaculture

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Abstract

Four leading Hungarian research organizations have joined forces to apply for funding for a consumer-driven development of the Hungarian aquaculture sector. The project GINOP-2.3.2-15-2016-00025, entitled "Market-driven innovative development of the genetic resources and production technology of cultured fish species (wels catfish, common carp, pikeperch)" with the acronym GOODFISH, was awarded in 2016 for 4 years by the Government of Hungary and the European Regional Development Fund. The project includes several objectives depending on the species involved. In the wels catfish, the objective is to develop a two-year production cycle with the combination of intensive fingerling rearing in closed systems and growout in ponds. This would also require the development of a specific catfish variety through selection based on molecular markers. In the pikeperch, the objective is the development of a commercial-scale larval and fingerling rearing technology, including broodstock management, larval and fingerling rearing as well as weaning to formulated feeds. In both species, a live and cryopreserved gene bank will be developed. The most extensive research is planned in the common carp: development of a new carp variety adapted to intensive culture; development of monosex female common carp stocks; immune system investigations; proteomic and gene expression studies; the use of fermented avian manure for feeding; development of a veterinary e-tool as well as economic studies are envisioned.

Keywords: Hungary, aquaculture, catfish, carp, pikeperch

Transplantation of freshwater fish spermatogonia

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Abstract

Development of surrogate technologies including the isolation and transplantation of early-stage germ cells offers new possibilities for the gene banking in aquaculture and conservation of genetic resources of fish. The objective of a Slovenian-Hungarian bilateral project was to develop methods for the cryopreservation and transplantation of freshwater fish spermatogonia. Experiments were carried out on several fish species including zebrafish (*Danio rerio*), goldfish (*Carassius auratus*), tench (*Tinca tinca*), common carp (*Cyprinus carpio*), brown trout (*Salmo trutta m. fario*), marble trout (*Salmo marmoratus*), rainbow trout (*Oncorhynchus mykiss*) and grayling (*Thymallus thymallus*) as donors as well as zebrafish, common carp, rainbow trout and tiger trout (*Salvelinus fontinalis* × *Salmo trutta*) as recipients. Spermatogonia were isolated following enzymatic digestion of either freshly extracted or cryopreserved gonads. Isolated cells were transplanted into the recipients using microinjection. Successful incorporation of germ cells into recipient gonads was observed when brown trout and grayling were used as donors and rainbow trout as recipients. Developing gonads derived from common carp spermatogonia transplanted into sterilized goldfish recipients were detected. Finally, zebrafish offspring successfully hatched from fertilization with donor-derived sperm stripped from recipient individuals and confirmed using protein fluorescence as well as molecular markers.

Keywords: surrogate production, spermatogonia, transplantation, cyprinids, salmonids

Endoparaziti divokoze na području Gorskoga kotara – preliminarni rezultati

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Sažetak

Divokoza (*Rupicapra rupicapra*) je zavičajna vrsta krupne dlakave divljači u Republici Hrvatskoj. Prema novijim podatcima ova vrsta obitava u Hrvatskoj u dvije podvrste, alpska divokoza (*Rupicapra r. rupicapra*) i balkanska divokoza (*Rupicapra r. balcanica*). Tijekom 2017. godine prikupljeno je 12 uzoraka probavnog sustava divokoza podrijetlom iz Gorkoga kotara. Uzorci su pregledani segmentalno (sirište, tanko crijevo, slijepo i debelo crijevo), otvoreni podužno škarama te je sadržaj ispran vodom kroz dva sita različitih veličina otvora (0,5 i 0,2 mm). Uzorak izmeta pregledan je metodama flotacije i sedimentacije, te IF na bičaša *Giardia* sp. Pretragom crijeva utvrđena je prevalencija pozitivnih uzoraka od 83%. Od vrsta parazita utvrđeni su oblići *Haemonchus contortus* (P=17%), *Trichuris ovis* (P=33%), *Chabertia ovina* (P=17%) i *Oesophagostomum venulosum* (P=67%). Pregledom mezenterija utvrđeni su razvojni stadiji trakavice *Taenia hydatigena* (*Cysticercus tenuicollis*) u prevalenciji od 33%. Parazitološkom pretragom izmeta utvrđena je prevalencija od 90%, i to: larve porodice *Protostrongylidae* (P=60%), jajašca oblića *Nematodirus* sp. (P=30%), *Marshallagia marshalli* (P=10%), *Capillaria* sp. (P=10%), *T. ovis* (P=19%), jajašca *Strongylida* (P=20%) i kokcidije *Eimeria* sp. (P=20%). Utvrđeni parazitološki nalaz sličan je nalazu u drugim državama, uz iznimku da u ovom istraživanju nisu pronađene trakavice u crijevima. Zanimljivost istraživanja čini i nalaz *Cysticercus tenuicollis*, razvojnog stadija trakavice *Taenia hydatigena* čiji su konačni nositelji razni mesojedi. Daljnja istraživanja neophodna su kako b se stekao primjeren uvid u parazitofaunu divokoze na području Gorskoga kotara.

Istraživanje je potpomognuto sredstvima projekta Hrvatske zaklade za znanost: ''DNA kao dokaz o distribuciji i vitalnosti ugrožene balkanske divokoze''.

Ključne riječi: divokoza, paraziti probavnog sustava, *Taenia hydatigena*, Gorski kotar

Endoparasites of chamois from the Gorski kotar region – preliminary results

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Abstract

Chamois (*Rupicapra rupicapra*) is autochthonous large game species in Croatia. According to the recent findings two subspecies of chamois are present in Croatia, Alpine chamois (*Rupicapra r. rupicapra*) and Balkan chamois (*Rupicapra r. balcanica*). During the 2017 gastrointestinal tract of 12 animals originating from Gorski kotar area were collected. Samples were analysed according to the segments: stomach, small intestine, caecum and large intestine, incised longitudinally and content was washed under water through two sieves with different mesh size (0.5 and 0.2 mm). Faecal samples were analysed using standard flotation and sedimentation methods, and IF method for *Giardia* sp. Macroscopic analysis revealed 83% prevalence of positive samples. Determined parasites were: *Haemonchus contortus* (P=17%), *Trichuris ovis* (P=33%), *Chabertia ovina* (P=17%) and *Oesophagostomum venulosum* (P=67%). Omentum of 33% of animals harboured *Cysticercus tenuicollis*, developmental stages of the tapeworm *Taenia hydatigena*. Coprological analysis revealed 90% prevalence of paraistes, including: Protostrongylus larvae (P=60%), and eggs of nematodes *Nematodirus* sp. (P=30%), *Marshallagia marshalli* (P=10%), *Capillaria* sp. (P=10%) and *T. ovis* (P=19%), strongylid eggs (P=20%) and *Eimeria* sp. oocysts (P=20%). Obtained results are similar to those in other studies, with exception that no tapeworms were found in intestines. Interesting finding is the presence of *Cysticercus tenuicollis* in 33% of samples, whose final hosts are various carnivores. Further analysis are needed for proper insight into parasitic fauna of chamois in the Gorski kotar region.

The research was supported by the Croatian Science Foundation grant: ''DNA kao dokaz o distribuciji i vitalnosti ugrožene balkanske divokoze''

Key words: chamois, gastrointestinal parasites, *Taenia hydatigena*, Gorski kotar

Development of an African catfish (*Clarias gariepinus*) breeding system with molecular genetic support

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Abstract

The African catfish (*Clarias gariepinus*) is one of the most important farmed fish species in Hungary and is also farmed in many other countries. It was first introduced to the country in the late 80s. Since then, broodstocks have not been selected purposefully and thus no distinct selected strains are available. In order to take advantage of selection and genetic analyses, a breeding program, in cooperation with producers, was started. As a first step, the genome of the African catfish was sequenced. Four genomic libraries were produced (insert size 350 bp, 500 bp, 5000 bp; 8000 bp) and were sequenced with the Illumina HiSeq (2000/2500) system. The total coverage was ~120x (136 billion bases). The sequence assembly was performed by Allpaths-lg, providing data for more than 90% of the estimated genome size (8783 scaffolds, 1,07 Gbp, N50:848271). The genome analysis was complemented with two transcriptome libraries. It was used to predict about 15,129 transcripts. In addition, an SNP-based genetic map is under construction based on ddRAD sequencing to build up a better genetic background for molecular genetic-based selection of important traits. For the purpose of development of different lines of fish for better body composition and better utilization of low fish meal feed, the plan is to start a broodstock selection as a second step of the program.

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Key words: *Clarias gariepinus*, breeding program, NGS sequencing, transcriptome.

Conservation of female genetic material in fish

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Abstract

Successful conservation of valuable genetic material is one of crucial goals of biology and biotechnology. Cryobanking offers the possibility for storage of frozen biological material for an indefinite period of time. In aquaculture practice, sperm cryopreservation is a common practice, adopted for many fish species. Due to the complex structure of fish eggs and embryos, their effective cryopreservation methodology has not yet been developed. In order to overcome the problem of conservation of female genetic material in fish, the main focus of this research was to develop protocols for cryopreservation of early-stage oocytes and oogonia. These cells have smaller sizes and thus higher surface/volume ratio, small amounts or no yolk material at all, and less complex structures when compared to mature eggs and therefore have better predispositions for survival after cryopreservation. A three-year study included several freshwater fish species: brown trout *Salmo trutta*, grayling *Thymallus thymallus*, European eel *Anguilla anguilla* and common carp *Cyprinus carpio*. Ovarian tissue of these species was cryopreserved or vitrified using various protocols in cryomedia of different compositions. This resulted in viability of cells post-thawing/warming ranging from 20 % (brown trout ovary) to 80 % (European eel ovary). Methods developed in this study enable successful conservation and further use of ovarian germline cells through germ cell transplantation or *in vitro* maturation.

Key words: ovarian germ cells, cryopreservation, vitrification

Cryopreservation and transplantation of common carp germ cells

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Abstract

Common carp *Cyprinus carpio* is one of the most cultured fish species in the world, however, data regarding preservation of gonadal tissue and surrogate production is still missing. A protocol for freezing common carp spermatogonia was developed through varying different factors along a set of serial subsequent experiments. Among the six cryoprotectants tested, the best survival was achieved with dimethyl sulfoxide (Me_2SO). In the subsequent experiment, the highest survival was obtained using 2 M Me_2SO at a cooling rate of -1 ˚C/min. When testing different tissue sizes and incubation times, the highest viability was observed when incubating 100 mg tissue fragments for 30 min. Finally, sugar supplementation did not yield significant differences. When testing different equilibration (ES) and vitrification solutions (VS) used for needle-immersed vitrification, no significant differences were observed between the tested groups. The functionality of cryopreserved cells was tested by interspecific transplantation into sterilized goldfish recipients. The exogenous origin of the gonads in goldfish recipients was confirmed by molecular markers and incorporation rate was over 40% in both groups at 3 months post transplantation. Results of this study can serve as an alternative way for long-term preservation of germplasm in carp which can be recovered in a surrogate recipient.

Key words: common carp, spermatogonia, cryopreservation

Dužinsko-maseni odnos i razina oksidativnog stresa hame (*Argyrosomus regius*) pri različitoj hranidbi

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Sažetak

Cilj istraživanja bio je odrediti dužinsko-maseni odnos i koncentraciju malondialdehida (MDA) kao bioindikatora oksidativnog stresa kod hame (*Argyrosomus regius*) pri različitoj hranidbi. Pokus je proveden s tri hranidbene skupine: CF (SP=48,0; SM=16,0), EXF (SP=52,0; SM=21,0), NCF (SP=56,0; SM=18,0) u dva ponavljanja (3x2) u morskim mrežnim kavezima dimenzija 9x5x5 m (V=225 m^3) na lokaciji otoka Bisage (44°01´28.6"S 15°13´11.2"I) tijekom razdoblja od 17 mjeseci (srpanj 2016. – studeni 2017.). Ribe (n=60) su na početku pokusa bile ujednačenih masa i duljina a tijekom pokusa su hranjene do sitosti. Na kraju pokusa, ribama su izmjerene totalne dužine i mase (TL, W) a iz svake hranidbene skupine uzorkovano je mišićno tkivo riba te je pohranjeno na -80°C do analize. Ribe hranjene EXF smjesom, imale su više vrijednosti završne mase i dužine tijela u odnosu na ribe hranjene CF i NCF. Utvrđeni dužinsko-maseni odnosi i Fultonov kondicijski faktor za pojedine tretmane bili su: $W= 0{,}006\ L^{3{,}186}$, K= 1,27 za hranidbenu skupinu CF, $W= 0{,}550\ L^{2{,}037}$, K=1,19 za NCF i $W= 0{,}015\ L^{2{,}953}$, K=1,22 za EXF. Kod riba hranjenih EXF smjesom utvrđena je značajno viša koncentracija malondialdehida (3,08 ± 1,41) μmol g^{-1} mišićnog tkiva nego kod ostalih hranidbenih skupina što moguće indicira višu razinu lipidne peroksidacije u tkivu. Riba hranidbene skupine CF imala je pozitivan alometrijski rast i najvišu kondiciju.

Ključne riječi: akvakultura, oksidativni stres, hranidba, *Argyrosomus regius*

Length – weight relationship and oxidative stress of meagre (*Argyrosomus regius*) fed with different feed mixtures

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Abstract

The aim of the study was to evaluate the length – weight relationship and the level of oxidative stress of meagre (*Argyrosomus regius*) fed with different feed mixtures. The experiment was performed in three feeding groups CF (CP=48,0; CF =16,0), EXF (CP=52,0; CF =21,0), NCF (CP=56,0; CF=18,0) with two repetitions (3x2) in marine net cages of 9x5x5 m (V = 225 m^3) on the island of Bisage (44° 01'28.6 "N 15° 13'11.2" E) over 17 months (July 2016 – November 2017). At the beginning of the experiment, the fish (n=60) were equal masses and lengths (TL, W) and during the trial were fed to satiety. At the end of the experiment, fish TL and W were measured and muscle tissue from each feeding group were sampled and stored at -80°C until analysis. Fish fed with EXF had higher final weight and total length compared with CF and NCF. Calculated length – weight relationship was $W= 0{,}006\ L^{3{,}186}$ for CF, $W= 0{,}550\ L^{2{,}037}$ for NCF and $W= 0{,}015\ L^{2{,}953}$ for EXF. Fish fed with EXF feed had significantly higher values of MDA (3,08 ± 1,41) μM g^{-1} of muscle tissue than in other feeding groups possible indicating a higher level of lipid peroxidation in the tissue. The fish of the feeding group CF had a positive allometric growth and the best condition.

Key words: aquaculture, oxidative stress, feeding, *Argyirosomus regius*

Stope mortaliteta i preživljenja šarana u proizvodnim uvjetima šaranskih ribnjaka u Republici Hrvatskoj

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Sažetak

Temeljem analiziranih i obrađenih rezultata proizvodno-tehnološke dokumentacije na šest velikih ribnjačarstva Republike Hrvatske (Donji Miholjac, Našička Breznica, Končanica, Poljana, Orahovica i Crna Mlaka) u razdoblju 1993-2015. godine, prosječni godišnji mortalitet (gubici) šarana (%) od nasada do izlova za jednogodišnju mlađ (od mladunaca ili mjesečnjaka do kraja uzgojne sezone, $Š_0$-$Š_1$) u prosjeku iznosi oko 60 %. Preživljenje (opstanak) mlađi iznosi oko 40 % od ukupnog broja nasađenih jedinki riba. Većina ribnjačarstava prakticira izravan nasad ličinki u mladičnjake (od 142.000-356.000 kom/ha) a preživljenje ($Š_L \rightarrow Š_1$) se procjenjuje na prosječnih 5,5 % dok su gubici procijenjeni na 94,5 %. Pri proizvodnji dvogodišnjeg šarana (od kategorije jednogodišnje mlađi do dvogodišnje mlađi, $Š_1$-$Š_2$), prosječni komadni gubici iznose 62,5 % dok je preživljenje 37,5 % od ukupnog broja nasađenih riba. Pri proizvodnji konzumnog šarana tj. od kategorije dvogodišnje mlađi ($Š_2$) do konzumne ribe ($Š_k$), prosječni komadni gubici iznose 44,5 % a preživljenje je procijenjeno na 55,5 % u odnosu na broj nasađenih riba.

Ključne riječi: riba, šaranski ribnjaci, gubici, opstanak, štetnici i neprijatelji riba

Mortality and survival rates of carp in the production conditions of carp fish farms in the Republic of Croatia

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Abstract

Average annual mortality and survival rates (%) of carp, from of stocking to harvesting, based on the analyzed and processed results of production and technological documentation of six large fish farms of the Republic of Croatia (Donji Miholjac, Našička Breznica, Končanica, Poljana, Orahovica and Crna Mlaka) in the period of 1993-2015 are as follows: yearling carp: from fry or summerlings to the end of the rearing season ($Š_0$-$Š_1$), mortality or losses are on average about 60%, and survival is about 40% of the total number of stocked fish. Most fish farms directly stock larvae into grow-out ponds (142,000-356,000 pcs/ha), and survival ($Š_L \rightarrow Š_1$) is estimated to be on average 5.5%, while losses are estimated to be 94.5%, n the production of two-year-old fish (carp) from the stage of yearling to two-year-old juveniles ($Š_1$-$Š_2$), average loss of individual fish is 62.5%, while survival is 37.5% of the total number of stocked fish. In the production of marketable fish (carp) from the stage of two-year-old fingerlings ($Š_2$) to marketable fish ($Š_k$), the average loss of individual fish is 44.5% and the survival is estimated to be 55.5% compared to the number of stocked fish

Keywords: fish, carp fish ponds, losses, survival, fish pests and predators

Zebrafish (*Danio rerio*) sperm cryopreservation

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Abstract

The development of cryopreservation of zebrafish *(Danio rerio)* sperm protocol was approached by cold exposure of the individual males. The research hypothesis was that when individual males are exposed to cold shock, the slowed metabolism can increase the survival of spermatozoa during cryopreservation. Group A (n=7) was kept at 18°C, and group B (n=7) at 24°C for 48 hours. The sperm was collected using abdominal massage. After collection, the cells were counted using hemocytometer, and progressive motility (PM) of sperm was measured with CASA. The diluted samples were loaded into 250-µl French staws and cooled from 4°C until -80°C at 10°C/min using a programmable freezer. The samples were thawed in a 40°C water bath and the sperm parameters were measured again. PM of fresh sperm was 65±16% in group A and 59±15% in group B. The cell number was $8\pm1\times10^6$ spermatozoa/µl and $2\pm1\times10^6$ sp./µl in the two groups, respectively. The post thaw PM of A was 16±10% and 15±10% in B. The number of the cells after thawing was $3\pm2\times10^5$ sp./µl in A and $2\pm2\times10^5$ sp./µl in B. No significant difference was found in PM or concentration of the two treated groups, however, cryopreservation affected the motility and concentration significantly. The research shows that the cooling of individuals does not result in higher cryosurvival of spermatozoa. The work was supported by the projects NKFIH K129127 EFOP-3.6.3-VEKOP-16-2017-00008 co-financed by the European Union and the European Social Fund.

Key words: cryopreservation, cold exposure, zebrafish, *Danio rerio*, spermatozoa

Determinacija spola i morfološke osobine sivog puha (*Glis glis*) s područja Dalmatinske zagore

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Sažetak

Sivi puh (*Glis glis*) je najveći pripadnik porodice puhova bez naglašenog spolnog dimorfizma. U ovom istraživanju u lovnoj sezoni 2017./2018. na području Dalmatinske zagore uzorkovalo se 32 jedinke puha (18 ženki i 14 mužjaka). Ciljevi rada bili su prikazati osnovne morfološke osobine sivog puha na području Dalmatinske zagore. Svakoj jedinki odredio se spol te su izmjereni morfološki parametri (masa, duljina tijela, širina prednjih i stražnjih udova i duljina repa) a zatim se odredila masa glave, repa, jetre, bubrega, srca i pluća (zajedno), punog probavila i randman. Dobivene morfološke osobine proučavane su uz znanstvenu i stručnu literaturu te su obrazložene njihove sličnosti i razlike. Rezultati su pokazali statistički značajnu razliku u duljini tijela bez repa i masi repa mužjaka u odnosu na ženke. Spolni dimorfizam sivog puha nije jasno izražen, iako su mužjaci u prosjeku nešto teži i veći, a ženke imaju veći raspon prednjih i stražnjih udova. Spol jedinke je sa sigurnošću moguće utvrditi pregledom vanjskih spolnih organa. Duljine tijela i ukupne mase puhova u Dalmatinskoj zagori, poklapaju se s populacijom na području Gorskog Kotara. Izmjereni morfološki parametri uglavnom se podudaraju s rezultatima sličnih istraživanja.

Ključne riječi: *Glis glis*, Dalmatinska zagora, morfologija, spolni dimorfizam, populacija

Determination of sex and morphological characteristics of edible dormouse (*Glis glis*) in the field of Dalmatian hinterland

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Abstract

Edible dormouse (*Glis glis*) is the largest of all dormouse species, without pronounced sexual dimorphism. During the hunting season of 2017/2018, 32 individuals (18 females and 14 males) were collected in the Dalmatian hinterland area. The aim of this paper was to show the basic morphological characteristics of the Edible dormouse in the Dalmatian hinterland area. Each individual's gender was determined and morphological parameters were measured: weight (head, tail, liver, kidney, heart, lung, digestive system and radman) and body length measurements (front and back width of the puck and tail length). The obtained morphological characteristics were compared with the scientific and professional literature and their similarities and differences were explained. Statistically significant differences between males and females was found in body length without the tail as well as tail mass, with males displaying greater values for both of these features. Sexual dimorphism in this rodent is not pronounced, though on average males tend to be larger and heavier than females, although females have a larger range of front and rear limbs. Gender of an individual Edible dormouse can be safely determined by looking at the external sex organs. Body length and total mass of Edible dormouse in Dalmatian hinterland is similar to the population in the Gorski Kotar region. The measured morphological parameters generally coincide with the results of similar studies.

Key words: *Glis glis*, Dalmatian hinterland, morphology, sexual dimorphism, population

Genetic diversity of European Barbary sheep populations

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Abstract

Barbary sheep (*Ammotragus lervia*) is a non-native ungulate from North Africa which has been established in the wild beyond its natural range due to intentional introductions and illegal releases. In Europe, four countries are inhabited with free-ranging Barbary sheep population: Croatia, Czech Republic, Italy and Spain. While being threatened in their native area, the majority of its exotic populations have showed high adaptability and formidable capacity to settle and expand their ranges. Non-native species cause changes to the ecosystems in which they are introduced. To understand their potential to establish and spread in the novel range, it is crucial to study their genetic diversity and population genetic structure. Population genetic parameters affect population viability and adaptive potential under environmental change. Here, we report the first genetic study of European Barbary sheep populations. We used ten microsatellite loci previously published to characterize and compare the genetic diversity and spatial pattern of genetic structure among study populations. We aimed to understand how current levels of genetic diversity and structuring vary among Barbary sheep populations that differ with regard to the time and source of introduction. Our results present important knowledge about origins of these populations and are the basis for further management.

Key words: non-native game species, microsatellite analysis, genetic diversity, spatial genetic structure

Cryopreservation of eel gonadal tissue

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Abstract

The European eel population status is endangered, and no improvement has been observed in the last 20 years. This critical situation necessitates the development of conservation procedures that extend beyond the current preservation and cryobanking practices. The aim of this research was to develop a protocol for cryopreservation of eel gonadal tissue though three serial experiments. In the first experiment, the effect of application of six different cryoprotectants (dimethyl sulfoxide - Me_2SO, ethylene glycol - EG, propylene glycol - PG, glycerol - Gly, methanol - MeOH, and 2-metoxyethanol - 2ME) on the germ cell survival was tested. Three cryoprotectants resulting with the highest survival rate (Me_2SO, EG and Gly in the case of ovaries and Me_2SO, EG and PG in the case of testes) were used for subsequent experiment and analysis of the effects of their different molar concentrations (1 M, 1.5 M and 2 M) as well as sugar (glucose, sucrose, trehalose) and protein (BSA and FBS) supplementation on the germline stem cell (GSC) survival. The final results show that the best survival rate of both ovarian and testicular GSCs was achieved by using 1.5 M Me_2SO. Varying protein and sugar supplementation did not have a significant effect on the post-thaw cell survival. This study presents the first step and a possible onset of applying germ cell manipulation technologies in the conservation of the European eel.

Key words: European eel, germline stem cells, cryopreservation

Mycotoxins induced DNA damage in common carp (*Cyprinus carpio*): investigations using LORDQ-PCR and DNA repair gene expression analyses

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Abstract

The purpose of our work was to investigate the DNA damaging effect of oral exposure of T-2 toxin (4.11 mg kg^{-1}), DON (5.96 mg kg^{-1}), aflatoxin (A, 400μg kg^{-1}) and sterigmatocystin (1 mg kg^{-1}, S1; 2 mg kg^{-1}, S2; and 4 mg kg^{-1}, S4) on the expression of DNA repair genes. In the first experiment, 1-year-old common carps (n=114) were divided into groups (control, T-2 and DON) and were treated for 3 weeks. Samples were collected weekly and analyzed using the LORDQ-PCR method. In the case of T-2 and DON, the number of lesions were the highest in the first week (1.33±0.22; 1.87±0.42), then reduced gradually by the third week (0.68±0.05; 0.82±0.27). In the second experiment the expression of four DNA repair genes (OGG1, GADD45AA, p53, HSP70) and a control gene (40S) was analysed in common carp (n=96).The fish were treated by gavage once in groups (control, A, S1, S2, S4), and liver samples were collected 8 and 16 hours post dosing. The expression of the OGG1 gene slightly increased in the aflatoxin, S1 and S2 treated groups, but decreased in the S4 group by the 8th hour. By the 16th hour, the OGG1 gene was upregulated, except in the S2 group. The HSP70 gene was upregulated in the aflatoxin, S1 and S2 groups, and strongly reduced in the S4 group compared to the other sterigmatocystin groups at the 8th hour. At the 16th hour, HSP70 was upregulated in each group, with the S4 group showing the highest expression. In conclusion, these mycotoxins have an impact on the DNA damage and also on the expression of DNA repair genes in common carp. The work was supported by the EFOP-3.6.3-VEKOP-16-2017-00008 grant.

Key words: T-2 mycotoxin, DON, sterigmatocystin, LORDQ-PCR, gene expression

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Stočarstvo

Proizvodni pokazatelji pijetlova pasmine kokoš hrvatica

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Sažetak

Kokoš hrvatica jedina je priznata izvorna pasmina kokoši u Hrvatskoj. Kombinirana je pasmina te se osim za proizvodnju jaja može koristiti i za proizvodnju visokokvalitetnog mesa dobivenog slobodnim uzgojem pijetlova. S obzirom da ozbiljnija istraživanja proizvodnih pokazatelja pijetlova kokoši hrvatica dosad nisu provedena, cilj ovog istraživanja bio je utvrditi količinu i konverziju krmne smjese, mortalitet tijekom uzgoja kao i završnu tjelesnu masu te prinos mesa. Istraživanje je provedeno na području Splitsko-dalmatinske županije, na četiri obiteljska gospodarstva u razdoblju od kolovoza do prosinca 2017. godine. Pri tome je na svakom gospodarstvu po završetku tople faze uzgoja, sa starošću pijetlova od 8 tjedana, izdvojeno po 20 pijetlova i smješteno u kućice uz koje se nalazio ograđeni zatravljeni ispust. Hrana i voda bile su dostupne *ad libitum* cijelo vrijeme uzgoja. Na kraju istraživanja, sa starošću pijetlova od 6 mjeseci izvršena je klaonička obrada te rasjek trupova. Prosječna tjelesna masa pijetlova iznosila je 2267 g uz konverziju od 7,19 kg krmne smjese po kg prirasta. Randman klanja iznosio je 71,43 %, a udio prsa 23,02 %, zabataka 18,22 % i bataka 16,87 %. Napravljena je i kalkulacija ekonomske koristi metodom izračuna pokrića varijabilnih troškova prema kojoj je po jednom pijetlu moguće ostvariti dobit od 32,75 kn. Uzimajući u obzir činjenicu da se radi o izvornoj pasmini te slobodnom sustavu držanja, ostvarena je zadovoljavajuća dobit.

Ključne riječi: hrvatske izvorne pasmine, kokoš hrvatica, proizvodni pokazatelji, slobodni uzgoj

Rooster production indicators of breed Hrvatica hen

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Abstract

Hrvatica hen is the only native breed of chicken in Croatia. It is a combined breed and can be used to produce high-quality meat and eggs obtained by free-range rearing system. Considering that serious studies of production characteristics of roosters have not been carried out so far, the aim of this study was to determine the amount of consumed feed mixture, feed conversion ratio, mortality during the rearing as well as the final body weight and meat yield. The research was conducted in the area of Split-Dalmatia County, on four family farms in the period from August to December 2017. At each farm after the end of the warm phase of rearing, at the age of 8 weeks, 20 roosters were separated and placed in poultry houses with grassy areas for grazing, enclosed by a fence. Food and water were available *ad libitum* all the time of rearing. At the end of the research, the roosters were slaughtered with the age of 6 months and weight of carcass parts was recorded. The average body weight of the rooster was 2267 grams with the feed conversion ratio of 7.19. Carcass percentage was 71.43 % and the shares of breasts, thighs and drumsticks in carcass were 23.02 %, 18.22 % and 16.87 % respectively. The economic benefit was also calculated using the cost-benefit calculations method. Accordingly, it is possible to make a profit of 32.75 HRK per one rooster. Taking into account a native breed and free-range rearing system, the achieved profit is satisfactory.

Key words: croatian native breed, hrvatica hen, production results, free range rearing

Utjecaj smanjenja udjela pigmenata u krmnim smjesama na prinos i kakvoću mesa brojlera

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Sažetak

Cilj rada bio je utvrditi utjecaj smanjenja udjela pigmenata u krmnim smjesama na prinos i kvalitetu mesa brojlera. Istraživanje u trajanju od 40 dana provedeno je na 200 jednodnevnih pilića Ross 308 koji su bili raspoređeni u 4 tretmana s 5 ponavljanja. Kontrolna skupina pilića (OM-100) bila je hranjena s krmnom smjesom sa standardnim iznosom komercijalnih pigmenata. Udio pigmenata u smjesama pokusnih skupina bio je 80% (OM-80), 60% (OM-60) i 40% (OM-40) standardnog iznosa. Sve skupine pilića bile su hranjene s krmnim smjesama jednakog kemijskog sastava. U svim krmnim smjesama su mikrominerali Zn, Cu, i Se bili dodani u organskoj formi. Istraživanjem je utvrđeno da smanjenje udjela pigmenata nije utjecalo na klaoničke pokazatelje, pH vrijednost i sposobnost zadržavanja vode prsnog mišića. Smanjenje udjela pigmenata u krmnim smjesama odrazilo se na povećanje svjetline L* te smanjenje crvenila a*, žutila b* i zasićenosti boje C* kože i prsnog mišića. Hedonističkim senzornim testom nisu utvrđene statistički značajne razlike između tretmana, iako je tretman OM-60 imao najbolje ocjene. Rezultati dobiveni primjenom Penalty analysis metode upućuju da je kod tretmana OM-100 i OM-80 došlo do smanjenja dopadljivosti izgleda toplinski obrađenog prsnog mišića kada je boja bila jako izražena, što možemo pripisati većem udjelu pigmenata. Stoga smatramo opravdanim smanjiti udjele pigmenata u krmnim smjesama pilića, što bi se moglo odraziti i na ekonomsku bilancu uzgoja.

Ključne riječi: brojler, pigmenti, senzorna svojstva, organski minerali, Penalty analysis

Effect of pigment share reduction in feed mixture on broiler yield and meat quality

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Abstract

The aim of this paper was to determine the effect of pigment share reduction in feed mixture on broiler yield and meat quality. The study was conducted on 200 Ross 308 chicks that were distributed in 4 treatments with 5 repetitions and fed for 40 days. The control group of chickens (OM-100) was fed with a feed mixture with a standard amount of commercial pigments. Pigment content in trial feed mixtures was 80% (OM-80), 60% (OM-60) and 40% (OM-40) of standard amount. All groups of chickens were fed with feed mixtures of the same chemical composition. In all feed mixtures microminerals Zn, Cu, were added in an organic form. It was found that pigment share reduction did not affect slaughter traits, pH value and water holding capacity of breast muscle. Reduction in pigment share in feed mixtures reflected in an increase in brightness L* and reduction in redness a*, yellowness b* and color saturation C* of skin and breast muscle color. Hedonistic sensory test did not establish statistically significant differences between treatments, although OM-60 treatment had the best scores. The results obtained using Penalty analysis method suggest that OM-100 and OM-80 treatments have decreased in appearance liking of heat-treated breast muscle when color was very expressed, what can be attributed to the higher pigment content. Therefore, we consider it justifiable to reduce the proportion of pigments in chicken feed mixtures, which could also be reflected in the economic outcome of breeding.

Key words: broiler, pigments, sensory properties, organic minerals, Penalty analysis

Genetska struktura izvornih pasmina magaraca u Hrvatskoj

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Sažetak

Cilj ovog istraživanja bio je procijeniti genetsku varijabilnost kod hrvatskih izvornih pasmina magaraca koristeći informacije iz rodoslovlja. Podatci o rodoslovlju uključuju 975, 3718 i 190 životinja istarske (ISM), primorsko-dinarske (PDM) i sjeverno-jadranske (SJM) pasmine. Za opis genetske varijabilnosti populacije analizirani su sljedeći parametri: koeficijent uzgoja srodstvu, ekvivalentni broj generacija, efektivni broj osnivača i prednika. Navedeni parametri procijenjeni su koristeći program Endog V4.8. Broj životinja uzgojenih u srodstvu iznosio je 104 (ISM), 163 (PDM) i 9 (SJM). Prosječna razina uzgoja u srodstvu iznosila je 1,8% (ISM), 0,8% (PDM) i 1,1% (SJM). Maksimalni uzgoj u srodstvu od 37,5% uočen je kod PDM. Maksimalne vrijednosti ekvivalentnog broja generacija iznosile su 1,9 (ISM), 1,6 (PDM) i 1,8 (SJM). Efektivan broj osnivača iznosio je 61 (ISM), 259 (PDM) i 31 (SJM). Efektivan broj prednika blago je niži od broja osnivača, iznoseći 56 (ISM), 253 (PDM) i 25 (SJM). Prvih je 19 (ISM), 115 (PDM) i 10 (SJM) prednika objasnilo 50% ukupne genetske varijabilnosti. S obzirom na to da pouzdanost procjene parametara ovisi o pravilnoj evidenciji na terenu, budući rad bi trebao biti usmjeren na povećanje kvalitete podataka o rodoslovlju kao i uključivanje procjena baziranih na molekularnim podacima.

Ključne riječi: analiza rodoslovlja, izvorne pasmine magaraca, uzgoj u srodstvu, efektivni broj prednika

Genetic structure in Croatian autochthonous donkey breeds

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Abstract

The objective of the study was to estimate genetic variability in Croatian autochthonous donkey breeds using pedigree information. Pedigree data included 975, 3.781, and 190 animals of Istrian (ISD), Littoral-Dinaric (LDD) and North-Adriatic (NAD) donkey breed. For the description of genetic variability, the following parameters were analysed: inbreeding coefficient, equivalent number of generations, number of founders and ancestors. Parameters were estimated using Endog V4.8 software. Number of inbred animals was 104 (ISD), 163 (LDD) and 9 (NAD), while average inbreeding was 1.8% (ISD), 0.8% (LDD), and 1.1% (NAD). Maximum inbreeding was 37.5% detected in LDD. Maximum values obtained for an equivalent number of known generations were 1.9 (ISD), 1.6 (LDD), and 1.8 (NAD). Effective number of founders was 61 (ISD), 259 (LDD) and 31 (NAD). The effective number of ancestors was slightly lower than effective number of founders as follows: 56 (ISD), 253 (LDD), and 25 (NAD). Number of ancestors explaining 50% variability in the gene pool was 19 in ISD, 115 in LDD, and 10 in NAD. Since the reliability of estimated parameters depends on the proper recording of pedigree in the field, the future work should be done to increase the quality of pedigree data and to include estimates based on molecular data.

Key words: pedigree analysis, autochthonous donkey breeds, inbreeding, effective number of ancestors

Senzorni profili dimljenih pršuta iz pet proizvodnih sezona

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Sažetak

Tradicionalna proizvodnja dimljenih pršuta usklađena je s godišnjim dobima tijekom kojih su optimalno iskorišteni povoljni vremenski uvjeti za svaku fazu proizvodnje. S obzirom na varijabilnost karakteristika butova i uvjeta proizvodnje tijekom godina, očekuje se da će proizvodna sezona utjecati na senzorni profil. Stoga je cilj rada bio utvrditi razlike u senzornim profilima između proizvodnih sezona i ustanoviti najprimjerenija svojstva za opisivanje pršuta. U istraživanju su korišteni podaci senzornih analiza 73 dimljena pršuta tijekom pet uzastopnih proizvodnih sezona od 2011. do 2015. godine. Senzorni profili su se sastojali od 18 svojstava i dobiveni su kvantitativnom deskriptivnom analizom pomoću 14 educiranih senzornih analitičara. Senzorne analize pršuta provedene su u kontroliranim uvjetima u listopadu svake sukcesivne godine. Statističkom obradom pomoću neparametrijskih testova utvrđeno je da se deset od 18 svojstava značajno razlikovalo između proizvodnih sezona ($P<0,05$). Primjenom analize glavnih komponenti objašnjeno je 45,53% ukupne varijance s prve dvije glavne komponente. Najveći doprinos u karakterizaciji glavnih komponenti imala su svojstva ujednačenost boje, vlažnost površine, mramoriranost, intenzitet dima, slatki i slani okus, topivost, arome po maslacu, biokemijske arome i postojanost arome. Razdvajanje proizvodnih sezona prema glavnim komponentama nije bilo u potpunosti izraženo, ali je bilo moguće opisati specifična obilježja pojedinih proizvodnih sezona. Na temelju rezultata možemo zaključiti da su senzorni profili bili značajno različiti i specifični za opisivanje pršuta iz pojedine proizvodne sezone.

Ključne riječi: pršut, dimljeni, senzorna svojstva, glavne komponente

Sensory profiles of smoked dry-cured ham from five production seasons

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Abstract

The traditional production of smoked dry-cured ham is aligned with the annual seasons, during which optimal weather conditions are optimally utilized for each stage of production. Given the variability of raw ham characteristics and production conditions over the years, it is expected that the production season will affect the sensory profiles. Therefore, the aim of this paper was to determine the differences in sensory profiles between production seasons and to establish the most suitable sensory traits for dry-cured ham characterization. In this study, sensory analysis data of 73 smoked ham during five consecutive production seasons from 2011 to 2015 were used. Sensory profiles consisted of 18 traits and were obtained by quantitative descriptive analysis using 14 educated sensory analysts. Sensory analyzes were carried out under controlled conditions in October each successive year. Statistical analysis by nonparametric tests showed that ten out of 18 traits differed significantly between production seasons ($P<0.05$). The principal component analysis explained 45.53% of the total variance with the first two principal components. Important contribution to the characterization of the principal components had color uniformity, surface moisture, marbling, smoke intensity, sweet and salty taste, solubility, butter flavor, biochemical aromas and after-taste. Separation of production seasons by principal components was not fully expressed but it was possible to describe the characteristics of each production seasons. It can be concluded that sensory profiles were significantly different and specific for describing smoked dry-cured hams from particular production season.

Key words: dry cured ham, smoked, sensory traits, principal components

Aktualna problematika u uzgojno-selekcijskom radu na crnoj slavonskoj svinji

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Sažetak

U posljednjih 10 godina došlo je do značajnog povećanja populacije Crne slavonske svinje. Prema podatcima Hrvatske poljoprivredne agencije, u 2017. godini u Hrvatskoj je pod matičnom evidencijom bilo 1.930 krmača i 242 nerasta ove pasmine. Nažalost, uzgojno-selekcijski postupci koji se trenutno provode od strane nadležnih institucija nisu u službi očuvanja, stabiliziranja i unapređenja pasmine. Manjkavosti u sustavu kontrole proizvodnosti rezultiraju činjenicom da je gotovo 50% populacije Crne slavonske svinje izvan kontrole proizvodnosti (obveza prijave samo jednog legla godišnje). Nadalje, sustav označavanja (ušne markice) nije prilagođen specifičnim uvjetima držanja ove pasmine (držanje na otvorenom i ispustima), što dovodi do čestog gubitka identifikacijskih oznaka, kao i brisanja identifikacijskog broja s ušnih markica. Veliki problem predstavlja i činjenica da se godišnje ocijeni i u matičnu evidenciju uvede gotovo jednaki broj rasplodnih nerasta kao i krmača, a preko 70% umatičenih nerasta pripada istoj liniji. No, najveći problem predstavlja izostanak genomskih metoda u provedbi uzgojno-selekcijskog programa koji se temelji isključivo na ocjeni i procjeni fenotipskih svojstava, što je rezultiralo visokim stupnjem uzgoja u srodstvu koji u značajnoj mjeri ugrožava opstojnost pasmine. Prvi i nužni korak u očuvanju i unapređenju Crne slavonske svinje treba biti provjera rodovnika molekularno-genetskim metodama i genotipizacija svih rasplodnih grla, kao osnova uzgojno-selekcijskog programa.

Ključne riječi: Crna slavonska svinja, uzgojni program, označavanje, genotipizacija

Current issues in breeding-selection work on Black Slavonian pig

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Abstract

In the last 10 years there has been a significant increase in the population of Black Slavonian (Crna Slavonska) pigs. According to the Croatian Agricultural Agency data, in 2017 Croatia had 1,930 sows and 242 boars of this breed. Unfortunately, breeding-selection procedures currently carried out by competent institutions are not in the service of preservation, stabilization and breeding of the breed. The deficiencies in the productivity control system result in the fact that almost 50% of the Black Slavonian pig population is out of control of productivity (only one litter annually applies). Furthermore, the identification system (ear tags) is not tailored to the specific conditions of keeping this breed (outdoor and outlet), which leads to frequent loss of identification marks, as well as deleting the identification number of the ear tags. A big problem is the fact that the annually is introduced in the herd book almost the same number of breeding boars as sows, and more than 70% of introduced boars belong to the same line. However, the biggest problem is the absence of genomic methods in the breeding selection program based solely on the evaluation and assessment of phenotypic traits, resulting in a high degree of inbreeding that significantly compromises the survival of the breed. The first and necessary step in the conservation and improvement of the Black Slavonian pigs should be the genetic testing of pedigree by molecular genetic methods and the genotyping of all breeding animals as the basis of breeding selection program.

Key words: Black Slavonian pig, breeding program, marking, genotyping

Autentifikacija proizvoda od Crne slavonske pasmine svinja pomoću mikrosatelitnih markera

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Sažetak

"Brendiranje" crne slavonske (CS) pasmine svinja u zadnjem desetljeću dovelo je do povećanog interesa potrošača za kupnjom mesnih proizvoda od CS. U prošloj godini u pojedinim trgovačkim lancima pojavili su se mesni proizvodi deklarirani kao proizvodi od CS.

Da bi se utvrdila njihova autentičnost, izolirana je DNK iz 20 mesnih proizvoda (11 iz različitih trgovačkih lanaca i 9 od lokalnih proizvođača) i genotipizirana s 25 mikrosatelitskih markera (MS) s ISAG / FAO popisa preporuka, grupiranih u 3 multipleks PCR reakcije. Genotipovi mesnih proizvoda uspoređeni su s genotipovima 70 crnih slavonskih svinja CS), 19 landrasa, 14 velikih jorkšira, 9 duroka, 14 pietrena, 15 PIC i 10 Topigs svinja, genotipiziranih s istim setom MS markera. Analiza strukture populacije provedena je pomoću programa Structure, a vizualizacija rezultata Structure programa provedena je pomoću Clumpak programa.Među 11 analiziranih mesnih proizvoda iz trgovačkih lanaca, samo su dva uzorka bila povezana s CS pasminom, dok su ostali pokazali mješavinu različitih komercijalnih pasmina svinja. Situacija je bila bolja u mesnim proizvodima domaćih proizvođača, gdje je kod 3 uzorka dokazano miješanje CS pasmine s komercijalnim pasminama svinja, dok su ostali proizvodi bili od čiste CS. Može se zaključiti da je popularizacija i širenje mesnih proizvoda od CS pasmine bez odgovarajuće kontrole omogućila pojavu neautentičnih proizvoda na tržištu.

Ključne riječi: Crna slavonska pasmina svinja, autentifikacija mesnih proizvoda, mikrosatelitni markeri

Authentication of Crna slavonska pig breed products with microsatellite markers

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Abstract

"Branding" of the Crna slavonska (Black Slavonian, BS) pig breed in the last decade has led to the increased interest among consumers for buying meat products of BS breed. In the past year meat products, declared as BS pig breed products, appeared in certain chain stores. In order to determine their authenticity, DNA was isolated from 20 meat products (11 from different chain stores and 9 from local producers) and genotyped with 25 microsatellite (MS) markers from the ISAG/FAO recommendation list, grouped into 3 multiplex PCR reactions. The genotypes of meat products were compared to the genotypes of 70 BS pigs, 19 Landrace, 14 Large White, 9 Duroc, 14 Pietrain, 15 PIC and 10 Topigs pigs, assessed with the same set of MS markers. The analysis of the population structure was performed with the Structure program, and the visualization of the Structure results was conducted in Clumpak software. Among 11 analyzed meat products from chain stores, only two samples clustered together with BS breed, while other showed admixture of different commercial pig breeds. The situation was better in meat products from local producers, where 3 samples showed slight admixture of BS breed with commercial pig breeds, while others were pure BS. The conclusion is that popularization and expansion of BS breed meat products without appropriate control has enabled appearance of inauthentic products on the market.

Key words: Crna slavonska pig breed, meat products authentication, microsatellite markers

Osnovni muzni pokazatelji krava jersey pasmine

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Sažetak

Cilj rada bio je izmjeriti i prikazati osnovna muzna svojstva krava jersey pasmine na primjeru jedne suvremene govedarske farme za proizvodnju mlijeka. Za mjerenje muznih svojstava koristio se mjerni uređaj LactoCorder, a mjerili su se slijedeći parametri: količina mlijeka po mužnji (KMM), prosječni (PPM) i maksimalni protok mlijeka (MPM), te trajanje glavne (GFM) i cijele mužnje (TM). Krave jersey pasmine imale su prosječnu količinu mlijeka po mužnji 11,99 kg, dok su PPM i MPM mlijeka u prosijeku iznosili 2,01 odnosno 3,09 kg/min. Trajanje GFM i TM u prosjeku su iznosili 5,99 odnosno 10,13 minuta. Utvrđena je nešto veća zastupljenost poželjnijih krivulja protoka mlijeka (pravokutna i stepenasta) u iznosu od 58 %, dok su manje poželjne krivulje bile zastupljene sa 42 % (bimodalna i neodređena). Sa stajališta dobre muznosti, krave jersey pasmine iz ovoga istraživanja imaju nešto niži prosječni protok mlijeka, a samim tim i duže trajanje mužnje. Uočena je velika zastupljenost bimodalnih krivulja, koje ukazuju na moguću neusklađenost muznog uređaja (sisne čaše) sa dimenzijama vimena krava jersey pasmine. Na osnovu dobivenih rezultata nužna su daljnja istraživanja muznosti krava ove novije pasmine za proizvodnju mlijeka u Republici Hrvatskoj. Nadalje, nužna je određena korekcija na muznim uređajima kako bi se poboljšao tijek mužnje a samim tim i kvaliteta mužnje krava jersey pasmine.

Ključne riječi: krave, jersey, muzna svojstva, LactoCorder

Basic milkability properties of the cows Jersey breed

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Abstract

The aim of the study was to measure and show the basic milkability traits of the cows' jersey breed from the one modern dairy farm. The LactoCorder measuring device was used to measure the milkability traits, and the following parameters were measured: milk yield per milking (MYM), average (AMF) and maximum milk flow (MMF), as well as duration of the main (MMD) and whole milking (MD). The cows of the jersey breed had an average milk yield of 11.99 kg while the AMF and MMF on average were 2.01 or 3.09 kg/min. The average duration of MMD and MD were 5.99 and 10.13 minutes, respectively. There was a somewhat greater representation of the more desirable milk flow curves (rectangular and stepped) in the amount of 58%, while the less desirable curves were represented by 42% (bimodal and unspecified). In addition, there is a great representation of the bimodal curve, indicating the possible incompatibilities of milking device (teat cup) with dimensions of the udder Jersey breed. Based on the obtained results, further research on the milkability for cow's of this new breed for milk production in the Republic of Croatia, is necessary. Furthermore, it is necessary to a certain correction of the milking device to improve the flow of milking and therefore the quality of milking for cows of Jersey breed.

Key words: cows, Jersey, milkability traits, LactoCorder

Genetska raznolikost linija hrvatskog posavca

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Sažetak

Hrvatski posavac izvorna je pasmina konja koja zadnja dva desetljeća bilježi blagi rast i čija brojnost populacije trenutno iznosi oko 4.870 grla. Sustavno praćenje i briga o uzgoju započinje devedesetih godina XX. stoljeća kroz *in situ* zaštitu i očuvanjem genetske raznolikosti. Cilj istraživanja je procjena genetske raznolikosti linija hrvatskog posavca. Od 50 pastuha sakupljena je dlaka iz koje je izolirana DNA. Analizom 15 mikrosatelitnih markera determinirano je ukupno 109 alelnih varijanti. Utvrđen broj alela po lokusu iznosio je od 5 (*HTG7*) do 11 (*ASB17*) s prosječnom vrijednosti 7,27 alela po lokusu. Polimorfna informativnosti markera (*PIC*) za sve lokuse iznosila je 0,67. Vrijednosti promatrane (H_O) i očekivane heterozigotnost (H_E) bile su u rasponu od 0,300 do 0,940 i od 0,274 do 0,843, sa srednjom vrijednosti od 0,742 (H_O) i 0,713 (H_E). Koeficijent uzgoja u srodstvu (*FIS,* -0.043) upućuje na višak heterozigotnih jedinki koji nije bio značajan. Od Hardy-Weinbergove ravnoteže značajno su odstupala samo dva lokusa ($p<0,05$). Analiza glavnih koordinata upućuje da je znatan dio genetske varijabilnosti sadržan unutar populacije te da ne postoje zasebni *klasteri* unutar populacije. Rezultati upućuju da je unutar linija hrvatskog posavca očuvan znatan udio genetske raznolikosti. Dobiveni rezultati olakšati će provođenje uzgojnog programa hrvatskog posavca te tako doprinijeti očuvanju genetskog identiteta i raznolikosti pasmine.

Ključne riječi: hrvatski posavac, linije pastuha, genetska raznolikost, program očuvanja

Paternal genetic diversity in Croatia Posavina Horse

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Abstract

Croatian Posavina horse is the native horse breed of horses which population number slightly increasing in the last two decades and nowadays counts about 4,870 heads. Systematic monitoring and care about breed begins in the nineties of the twentieth century, relying on the *in situ* protection and maintaining genetic diversity. This study aimed at screening genetic diversity and differentiation in sires of Croatian Posavina horse. A total of 50 hair samples were collected and genomic DNA was extracted. The 15 microsatellites were examined and a total of 109 alleles was identified. The number of alleles at a single locus ranged from 5 (*HTG7*) to 11 (*ASB17*) with the mean of 7.27 alleles per locus. The mean of polymorphism information content (*PIC*) value for all loci was 0.67. The observed and expected heterozygosity ranged from 0.300 to 0.940 and from 0.274 to 0.843, with an overall mean of 0.742 (H_O) and 0.713 (H_E) respectively. The inbreeding estimates (*FIS*) of -0.043 indicate excess of heterozigotes which was not significant. Only two microsatellite loci exhibited significant ($p<0.05$) departures from the Hardy–Weinberg equilibrium. Principal coordinate analyses showed that the important amount of genetic variation was within population and without clustering. The results indicate that the certain amount of genetic diversity is maintained in sire lines of Posavina horse. These results will facilitate breeding programs for Croatian Posavina horse and contribute to conservation of genetic identity and diversity.

Key words: Croatian Posavina horse, sire line, genetic diversity, conservation program

Utjecaj probiotika na proizvodnost i zdravstveno stanje peradi i svinja

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Sažetak

Probiotici su definicijom živi mikroorganizmi koji pozitivno utječu na zdravlje domaćina, ako ih se unosi u optimalnim količinama. Oni pozitivno utječu na održanje mikrobiološke i imunološke ravnoteže u crijevima, a samim time i na zdravstveno stanje, dobrobit i proizvodne pokazatelje životinja. Probiotici se sastoje od jednog ili više sojeva, istih ili različitih bakterija, čije je djelovanje povoljno za organizam. Najčešće korišteni probiotici su različite vrste roda *Bifidobacterium*, *Lactobacillus* i *Strepococcus*. Dodavanjem probiotika u odgovarajućoj količini u krmnu smjesu, štiti se organizam životinja od utjecaja patogenih mikroorganizama, što ima pozitivan učinak na njihovo zdravlje. Osim pozitivnog zdravstvenog učinka, probiotici imaju pozitivno djelovanje i na proizvodne parametre kod životinja, i to prvenstveno, kroz utrošak i konverziju hrane, bolji prirast, poboljšanje tjelesne mase, randman te kakvoću trupova i mesa, primjerice, leglo prasadi kojoj su dodavao probiotik imalo su za 0,7% više odbijene prasadi po leglu, stopa mortaliteta bila je niža za 42%, a masa prije odbića veća za 5% nego kod kontrolne skupine. Upotreba probiotika koji je sadržavao *Lactobacillus acidophilus,* inaktivirani pekarski kvasac, vitamin C i laktozu kod brojlera na kraju tova od 42 dana, rezultirala je povećanjem prosječne tjelesne mase i prirasta te boljom konverzijom hrane. Cilj ovoga preglednog rada je prikazati utjecaj dodatka probiotika na proizvodno i zdravstveno stanje peradi i svinja.

Ključne riječi: probiotici, proizvodnost, zdravlje, svinje, perad

The influence of probiotics on the productivity and health of poultry and pigs

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Abstract

According to a definition, probiotics are live microorganisms that, taken in optimum quantities, have a positive effect on the health of their hosts. They help maintain microbiological and immunological balance in bowels, thus improving health condition, welfare and production indicators of animals. Probiotics comprise one or more strains of the same or different bacteria, whose effect is beneficial to the organism. The most frequently used probiotics are various species of the genera *Bifidobacterium*, *Lactobacillus* and *Strepococcus*. If an adequate quantity of probiotics is added to the feed, animal organisms are protected against the impact of pathogenic microorganisms, thus improving the health of animals. In addition to this positive effect on animal health, probiotics also have a positive impact on production parameters in animals, primarily in terms of feed consumption and conversion, better weight gain, improved body weight, dressing percentage and the quality of carcass and meat. For example, when probiotics were added to the piglet feed, the percentage of weaned piglets per litter increased by 0.7%, the mortality rate decreased by 42% and body weight prior to weaning was 5% higher than in the control group. Use of probiotics that contained *Lactobacillus acidophilus,* inactivated baker's yeast, vitamin C and lactose at the end of the 42-day fattening cycle for broilers resulted in increased average body weight and weight gain as well as better feed conversion. The aim of this review article is to present the impact of probiotics on the production and health of poultry and pigs.

Key words: probiotics, productivity, health, pigs, poultry

Utjecaj sustava držanja i tjelesnih masa crnih slavonskih svinja na njihovu mesnatost i kvalitetu mesa

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Sažetak

Istraživanje je provedeno s po 24 svinje iz otvorenoga (ekstenzivnoga) i poluotvorenoga (poluintenzivnoga) sustava, od kojih su 12 muških kastrata i 12 nazimica. Svinje u oba sustava bile su tovljene do 100 kg i 130 kg tjelesne mase. Svinje iz otvorenoga sustava hranjene su na pašnjaku i na strništima, uz minimalno prihranjivanje kukuruzom tijekom zime, kada nema zelene mase. Svinje iz poluotvorenoga sustava hranjene su po volji obrokom kombiniranog od krmne smjese i zelene lucerne. Krmna smjesa u prvoj fazi tova (do 60 kg tjelesne mase) imala je 14 % sirovih proteina i 13,37 MJ ME/kg, a u drugoj fazi tova (60 – 130 kg tjelesne mase) imala je 12 % sirovih proteina i 13,34 MJ ME/kg. Disekcija ohlađenih (+4°C) desnih svinjskih polovica obavljena je prema modificiranoj metodi Weniger i sur. (1963). Kvaliteta mesa (*Muscullus longissimus dorsi*) istražena je u pogledu pH vrijednosti, sposobnosti vezanja vode i boje. Mesnatost svinjskih polovica bila je veća kod svinja manjih tjelesnih masa (100 kg) u odnosu na svinje većih tjelesnih masa (130 kg) u oba sustava držanja, ali su te razlike bile značajne ($p<0,05$) samo u poluotvorenome sustavu. Svinje iz otvorenoga sustava imale su mesnatije polovice u odnosu na svinje iz poluotvorenoga sustava i pri manjim (100 kg) i pri većim (130 kg) tjelesnim masama, ali ne i statistički značajno ($p>0,05$) (49,23 % i 44,99 % : 46,56 % i 42,82 %). Utvrđen je značajan utjecaj sustava držanja i tjelesne mase svinja na neke pokazatelje kvalitete mesa. Meso svinja manje tjelesne mase iz otvorenog sustava imalo je značajno više ($p<0,01$) sirovih proteina od mesa od svinja istih tjelesnih masa u poluotvorenom sustavu.

Ključne riječi: crne slavonske svinje, tjelesna masa, sustav držanja, mesnatost, kvaliteta mesa

Influence of the Keeping System and Body Weight of the Black Slavonian Pigs on Meatiness and Meat Quality

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Abstract

The research was carried out on 24 pigs kept in the open (extensive) and 24 pigs kept in the semi-opened (semi-intensive) keeping system. In each group there were 12 barrows and 12 gilts. Pigs in both systems were fattened up to 100 kg and 130 kg body weight. The pigs from the open system were grazing on pastures and stubble-fields, with minimum addition of corn during winter, when there is no green forage, whereas the pigs kept in the semi-opened system were fed *ad libitum* with a combination of feed mixture and green alfalfa. The feed mixture used in the first fattening phase (up to 60 kg body weight) contained 14% crude protein and 13.37 MJ ME/kg, and in the second phase (60 - 130kg body weight) it contained 12 % crude protein and 13.34 MJ ME/kg. Dissection of cooled (+4°C) right half-carcasses was carried out according to modified Weniger et al. method (1963). Meat quality (*Muscullus longissimus dorsi*) was examined in terms of the pH value, water binding capacity and colour. Meatiness of half-carcasses in both production systems was higher in pigs of lower body weight (100 kg), compared to pigs of higher body weight (130 kg). However, these differences were significant ($p<0.05$) only in the pigs kept in the semi-opened system. Pigs from the opened system had meatier carcasses in relation to pigs from the semi-opened system both at lower (100 kg) and higher (130 kg) body weights, but it was not statistically significant ($p>0.05$) (49.23% and 44.99% : 46.56% and 42.82%). A significant influence of the keeping system and body weight was detected for some indicators of meat quality. Meat of pigs of lower body weight from the open system had a significantly higher ($p<0.01$) level of crude protein than meat of pigs kept in the semi-open system at the same body weight.

Key words: Black Slavonian pigs, body weight, production system, meatiness, meat quality

Utjecaj smještaja i hranidbe na zdravlje janjadi od poroda do odbića

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Sažetak

Posljednjih godina u Hrvatskoj se bilježi stalni rast otkupne cijene svježeg sirovog ovčjeg mlijeka. U intenzivnoj proizvodnji ovčjeg mlijeka janjad se rano odvaja od majki i hrani pomoću automata za mlijeko. Uslijed nepravilnog korištenje automata, i mliječne zamjene, može doći do poremećaja u zdravlju janjadi. Cilj istraživanja bio je utvrditi utjecaj takovog načina hranidbe na zdravlje janjadi. Istraživanje je provedeno na farmi mliječnih ovaca na populaciji od 500 janjadi hranjenoj mliječnom zamjenom pomoću automata za mlijeko. Zdravlje janjadi praćeno je od razdoblja odvajanja od majki do odbića. U jednom boksu držana je grupa od trideset janjadi, Na zidu boksa nalazile su se tri gumene sise povezane cijevima sa automatom za napajanje. Janjadi je od sedmog dana ponuđena voda i gotova krmna smjesa. U istraživanju je pored utvrđivanja uzroka pojave bolesti i uginuća janjadi provedena detaljna analiza tehnologije uzgoja s ciljem utvrđivanja pogrešaka. Istraživanjem je utvrđeno uginuće 67 janjadi. Kliničkim pregledom, razudbom i koprološkom pretragom utvrđeno je da je janjad najčešće ugibala od enterotoksemije, kokcidioze i pastereloze. Pojava bolesti bila je posljedica neprovođenja preventivnih zahvata tijekom zadnje trećine gravidnosti ovaca, zatim napajanjem hladnom mliječnom zamjenom te promjenom tri dobavljača mliječne zamjene u razdoblju od mjesec dana. Utvrđeno je da je upala pluća posljedica loših mikroklimatskih uvjeta u staji. Rezultati istraživanja ukazuju da se većina problema kod hranidbe janjadi pomoću automata za mlijeko može spriječiti preventivnim zahvatima u gravidnosti ovaca npr. vakcinacija protiv enterotoksemije, boljom higijenom smještaja i napajanja te pravilnim korištenjem automata.

Ključne riječi: janjad, automat, mliječna zamjena, zdravlje

The impact of housing and feeding on the health of lambs from birth to weaning

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Abstract

During the last few years in Croatia, a constant growth of redemption prices for raw sheep milk has been noted. In intensive production of sheep milk the lambs are weaned quite early and are fed using automatic milk feeders. Improper use of the automatic feeders and milk supplement can lead to disorders in lamb health. The objective of this research was to establish the effect of this method of feeding on lamb health. The research was conducted on a farm of sheep used for milk with 500 lambs fed with milk supplement using an automatic milk feeder. The health of the lambs was monitored since separation from the ewe to weaning. A group of 30 lambs were kept in one pen. There were 3 rubber teats on the wall of the pen connected via hoses to an automatic feeder. The lambs were offered water and compound feed. Apart from determining the cause of disease and death of lambs, a detailed analysis of breeding technology was also conducted in order to determine mistakes being made. The study established the death of 67 lambs. By a clinical examination, necropsy and coprological examination it was determined that the lambs died of enterotoxaemia, coccidiosis and pasterosis. The diseases occurred due to lack of preventive procedures during the last third of gestation, feeding cold milk supplement and due to changing three suppliers of milk supplement in one month. It was determined the pneumonia was caused by poor microclimate conditions in the barn. The results of the research point to the fact that most problems in feeding lambs with an automatic milk feeder can be prevented by implementing preventive procedures during gestation, i.e. vaccinate for enterotoxaemia, keeping the pens clean and proper use of automatic feeders.

Key words: lambs, automatic feeder, milk supplement, health

Utjecaj pasmine i spola na rezultate natjecanja u daljinskom jahanju

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Sažetak

Daljinsko jahanje je konjička disciplina koja zadnjih desetljeća dobiva na značajnosti. Sklonost jahača prema daljinskom jahanju potaknuta je atraktivnošću natjecateljskih staza, pogodnošću različitih pasmina za natjecanja te individualnost u pripremi natjecateljskih konja. Premda se u daljinskom jahanju koristi više pasmina oba spola, nedovoljno su istražene različitosti između pasmina i spolova naspram natjecateljskih plasmana. Provedeno istraživanje obuhvatilo je 657 natjecateljska rezultata na održana 42 daljinska natjecanja u razdoblju 2011.-2016. godine. Istraživanje je obuhvatilo osam pasmina konja oba spola. Rezultati istraživanja ukazuju da su obzirom na plasmane najbolje rezultate postigli konji pasmina gidran, araber i arapski punokrvnjak (2,53; 2,67; 2,85). Najbolje prosječne brzine kretanja konja zapažene su kod arapskog punokrvnjaka, arapskog konja i toplokrvnjaka (14,06; 14,05; 14,05) dok je hrvatski toplokrvnjak postizao najmanje prosječne brzine kretanja (13,33 km/h; $p<0,05$). Utjecaj spola na natjecateljske plasmane te prosječnu brzinu kretanja konja na stazi je značajan ($p<0,001$). Muška grla (pastusi i kastrati) ostvarivali su povoljnije natjecateljske rezultate i nešto veću prosječnu brzinu kretanja (+0,68 km/h; $p<0,001$). Utjecaj spola jahača na natjecateljski plasman i prosječnu brzinu kretanja na stazi nije imao značajnost. Opažanja temeljena na provedenom istraživanju daju smjernice uzgoja konja za daljinsko jahanje.

Ključne riječi: daljinsko natjecanje, pasmina, spol, plasman, brzina

Effect of breed and sex on the results in endurance competition

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Abstract

Endurance is equestrian discipline that over last decades gains attention. Tendency of rider towards endurance riding was initiate by the attractiveness of the race tracks, the suitability of different horse breeds for competition, and the individual approach in horse training. Although different horse breeds of both sexes are used in endurance, the differences between breeds and sex versus placements are insufficiently explored. The conducted survey included 657 competition results from 42 endurance competition in the period between 2011-2016. The study included eight breeds of both sexes. Results indicate that Gidran, Araber, and Purebred Arab achieve the best results in terms of placement (2.53, 2.67, and 2.85). The best average speed were observed in Purebred Arab, Arabian Bred and Warmbloods (14.06, 14.05, 14.05) while Croatian Warmblood has minimum average speed (13.33 km/h, $p<0.05$). Effect of sex on placement and average speed on track is significant ($p<0.001$). Male individuals (stallions and geldings) achieved more favorable results in competition and slightly higher average speed (+0.68 km/h, $p<0.001$). Influence of the rider gender on the placement and on the average speed was not significant. Observations based on this research provide breeding guidelines for the endurance horses.

Key words: endurance, breed, sex, placement, speed

Sastav masnih kiselina i oksidativna stabilnost mišićnog i masnog tkiva turopoljskih svinja iz uzgoja na otvorenom

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Sažetak

Turopoljska svinja (TS) je ugrožena hrvatska autohtona pasmina svinja koja se tipično uzgaja u otvorenom proizvodnom sustavu povezanom s lokalnim hrastovim šumama i plavnim livadama na području Turopolja i Lonjskog polja u središnjoj Hrvatskoj. Trenutno, unatoč državnoj potpori, populaciju TS čini samo 124 krmače i 17 nerasta, pa je za održiviji način očuvanja pasminu nužno bolje gospodarski iskoristiti i znanstveno istražiti. Cilj ovog rada bio je stoga utvrditi sastav masnih kiselina (MK) i oksidativnu stabilnost mišićnog i masnog tkiva TS iz otvorenog uzgoja. Uzorci *m.longissimus dorsi* -a (MLD) i leđne slanine (LS) 20 tovljenika (nazimice i kastrati, prosječne žive mase 94,8±11,55 kg i dobi 18,5±1,4 mjeseci) uzeti su 24 h *post mortem* u razini zadnjeg rebra i pohranjeni smrznuti (-20 °C) do analiza. Oksidativna stabilnost MLD i LS procijenjena je određivanjem reaktivnih supstanci 2-tiobarbiturne kiseline (TBARS test) izraženih u mg malondialdehida (MDA) po kg tkiva, u odmrznutim uzorcima nakon 0, 3 i 6 dana pohrane na 4 °C. Sastav MK određen je plinskom kromatografijom (Agilent 6890 GC, USA) nakon *in situ* transeterifikacije lipida. Prosječni sadržaji (g/100g ukupnih MK) zasićenih, mono-nezasićenih i poli-nezasićenih MK (ZMK, MNMK i PNMK) u MLD i LS iznosili su redom: 37,19 i 39,33, 47,38 i 46,75 te 15,43 i 13,92, uz sadržaj n-6 i n-3 PNMK: 14,30 i 12,81, odnosno 1,07 i 1,04. Oksidacija lipida (mg MDA/kg) u MLD i LS tijekom pohrane na hladnom je generalno rasla te bila podjednaka u oba tkiva 0. dana (0,04 i 0,03) i 3. dana (0,06 i 0,05), ali jače razvijena u LS 6. dana pohrane (0.13 i 0,22). Rad je dio projekta TREASURE financiranog u okviru programa Europske unije za istraživanja i inovacije Obzor 2020, br. potpore 634476.

Ključne riječi: turopoljska svinja, mišićno tkivo, masno tkivo, masne kiseline, oksidacija lipida

Fatty acid composition and oxidative stability of muscle and fat tissue of Turopolje pigs reared outdoors

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Abstract

Turopolje pig (TP) is an endangered Croatian autochthonous breed typically reared in an outdoor production system linked to local oak forests and marsh meadows in Turopolje region in Central Croatia. Currently, despite the state support, TP breed is still untapped, with a population of only 124 sows and 17 boars. Hence, to preserve TP in a more sustainable way, the breed needs to be better economically used and scientifically explored. This work aimed therefore to determine the fatty acid (FA) composition and oxidative stability of muscle and fat tissue of TP reared outdoors. The samples of *m.longissimus dorsi* (MLD) and back fat (BF) of 20 TP (barrows and gilts, weighted 94.8±11.55 kg and aged 18.5±1.4 months) were taken 24 h *post mortem* at the level of last rib and stored frozen (-20 °C) until analyses. Oxidative stability was measured in defrosted MLD and BF samples after 0, 3 and 6 days of cold storage at 4 °C, by assaying the 2-thiobarbituric acid-reactive substances (TBARS test), expressed as mg of malonaldehyde (MDA) per kg of tissue. The FA composition of MLD and BF samples was determined by using gas chromatography (Agilent 6890 GC, USA) following *in situ* transesterification of lipids. The average contents (g/100g of total FA) of saturated, monounsaturated and polyunsaturated FA (SFA, MUFA and PUFA) in MLD and BF were 37.19 and 39.33, 47.38 and 46.75 and 15.43 and 13.92, respectively. The PUFA n-6 and n-3 contents were 14.30 and 12.81 in MLD and 1.07 and 1.04 in BF. Lipid oxidation (mg of MDA/kg) in MLD and BF generally increased during cold storage with similar progress in both tissues at day 0 (0.04 and 0.03) and day 3 (0.06 and 0.05), but with the higher development in BF at day 6 (0.13 and 0.22). Work is part of the TREASURE project funded under European Union's Horizon 2020 research and innovation programme, grant no. 634476.

Key words: Turopolje pig, muscle tissue, fat tissue, fatty acids, lipid oxidation

Dodana ekonomska vrijednost mlijeka kopitara kroz prehrambene proizvode unutar EU-a

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Sažetak

Cilj rada je istražiti ponudu tržišta prehrambenih proizvoda od kobiljeg mlijeka na području Europske unije. Proizvodnju kobiljeg mlijeka u Europi prvi su se prihvatili Nijemci, Talijani i Francuzi, a potom se ona proširila i na Nizozemsku, Belgiju te Norvešku. Godišnja proizvodnja u EU iznosi oko 1.000 tona, te se kobilje mlijeko prodaje najviše u Rusiji i Francuskoj. Poljoprivredna gospodarstva i farme u zapadnoj Europi prepoznale su potencijale kobiljeg mlijeka te se usmjerile na ovu vrstu proizvodnje. Danas oni nude raznovrsne proizvode na tržištu, a također i turističke usluge na svojim farmama. Održivo poslovanje zabilježeno je na farmama usmjerenim na proizvodnju mlijeka kobile. Proizvodnja kobiljeg mlijeka može doprinijeti očuvanju pasmina konja i osigurati značajan broj radnih mjesta. Na taj način moguće je postići osim direktnih gospodarskih efekata, socio-ekonomske efekte koji su vidljivi u očuvanosti kulturnog krajolika i genetske raznolikosti. Osim svježeg mlijeka, moguće su razne prerade u fermentirane proizvode poput kumisa, jogurte, proizvodnja sira, čokolade ili kozmetičke proizvode poput sapuna, losiona, šampona. Potrošače treba upoznati i informirati o svojstvima mlijeka kopitara, njihovim pozitivnim učincima na zdravlje te širokim i raznolikim asortimanom proizvoda. Moguće ih je ponuditi na tržištu kako bi ostvarili potražnju, a samim time i proizvodnju mlijeka, poboljšanje same situacije u konjogojstvu te revitalizaciju autohtonih pasmina.

Ključne riječi: mlijeko kopitara, prerada, tržište, kobila, magarica

The added economic value of milk equine through food products within the European Union

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Abstract

The aim of this paper was to investigate the market offer for mare's milk-based food products in the EU. The production of mare's milk in Europe was first accepted by Germans, Italians and French, and then spread to the Netherlands, Belgium and Norway. The annual production of mare's milk in the EU amounts to about 1,000 tons, and the mare's milk is sold mostly in Russia and France. In Western Europe have recognized the potential of mare's milk and, therefore, focused on this type of production. Today they offer a variety of products on the market, as well as tourist services on their farms. Furthermore, sustainable business was recorded on farms focused on milk production. The production of mare's milk can contribute to the conservation of breeds of horses and, on the other hand, this production provides a significant number of jobs. In this way it is possible to achieve, in addition to the direct economic effects, socio-economic effects visible in the preservation of cultural landscapes and genetic diversity. Besides fresh milk, various food products are also possible, such as kumis, yogurt, cheese, chocolate or cosmetic products such as soaps, shampoos. The consumers need to be inform about the properties of equine milk, their health benefits and a wide and diverse range of products That can be offered to the market in order to accomplish the demand, and therefore production of milk, improvement of the situation in horse breeding and revitalization of autochthonous breeds.

Key words: equine milk, processing, market, mare, donkey

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Vinogradarstvo i vinarstvo

Masovna pozitivna selekcija sorte Zlatarica vrgorska (*Vitis vinifera L.*)

Željko ANDABAKA, Domagoj STUPIĆ, Kristina NOVAK, Zvjezdana MARKOVIĆ, Darko PREINER, Edi MALETIĆ, Jasminka KAROGLAN KONTIĆ, Iva ŠIKUTEN, Petra ŠTAMBUK, Ivana TOMAZ

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Sažetak

Zlatarica vrgorska je hrvatska autohtona sorta koja se uzgaja na području vinogorja Vrgorac i Neretva. Klonska selekcija Zlatarice vrgorske počela je 2018. godine provedbom masovne pozitivne selekcije na području vinogorja Vrgorac. Masovna pozitivna selekcija je provedena na 10 lokacija unutar vinogorja te su ukupno izdvojena 124 matična trsa. Masovna pozitivna selekcija obuhvatila je vizualnu ocjenu zdrastvenog stanja i ampelografsku evaluaciju (morfološke, fenološke i gospodarske kakakteristike). Na svakom matičnom trsu utvrđeni su broj grozdova i prirod (kg/trs) te osnovni kemijski pokazatelji kakvoće mošta (sadržaj šećera, ukupna kiselost, pH vrijednost). Srednje vrijednosti za sadržaj šećera u moštu kretale su se od 43,67 do 96,67 ^{0}Oe, dok je interval sadržaja ukupne kiselosti iznosio od 2,75 do 7,25 g/l. Raspon srednjih vrijednosti pH vrijednosti mošta iznosio je od 3,2 do 3,78. Utvrđene srednje vrijednosti priroda matičnih trsova kretale su se u rasponu od 0,18 do 17,98 kg/trs, a raspon srednjih vrijednosti broja grozdova po trsu je iznosio od 2 do 53 grozda. Rezultati su pokazali značajnu varijabilnost utvrđenih kvantitavnih i kvalitativnih svojstava. Spomenuto ukazuje na značajnu unutarsortnu varijabilnost populacije sorte Zlatarica vrgorska što je iznimno važno za nastavak postupka selekcije zdravstvenom i individualnom klonskom selekcijom.

Ključne riječi: vinova loza, Vrgorac, Zlatarica vrgorska, evaluacija, klonska selekcija

Mass positive selection of Zlatarica vrgorska variety (*Vitis vinifera L.*)

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Abstract

Zlatarica vrgorska is Croatian autochthonous grapevine variety mostly grown in vineyard area Vrgorac and Neretva. Clonal selection of Zlatarica vrgorska started in 2018 with mass positive selection in Vrgorac vineyard area. Mass positive selection was done in 10 locations within vineyard area. During the mass positive selection, 124 candidate clones were singled out. Visual evaluation of sanitary status and ampelographic evaluation of phenological, morphological and economical characteristics was carried out on mother vines. The procedure included an analysis of a number of clusters per vine, grape yield and must quality (sugar content, must acidity and pH value). Mean values for the sugar content in must was between 43,67 to 96,67 ^{0}Oe, while the interval of the must acidity mounted from 2,75 to 7,25 g/l. Interval of mean pH values of must was between 3,2 and 3,78. Determined mean values of grape yields were in an interval from 0,18 to 17,98 kg/vine, while the interval of the mean values of number of clusters per vine mounted from 2 to 53 clusters. The results showed a significant variability of the observed mother vines characteristics. Results show a great intravarietal variability of Zlatarica vrgorska variety population which is of an exceptional value for further process of sanitary and individual clonal selection.

Key words: grapevine, Vrgorac, Zlatarica vrgorska, evaluation, clonal selection

Kemijska i senzorna karakterizacija vina ´Chardonnay´

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Sažetak

Tijekom berbe 2017. proizvedena su četiri vina ´Chardonnay´ uz upotrebu različitih komercijalno dostupnih sojeva *Saccharomyces cerevisiae* kvasaca te je uspoređen njihov aromatski profil. Primjenom ekstrakcije na čvrstoj fazi te vezanim sustavom plinska kromatografija- spektrometar masa, u vinima je identificirano oko 80 hlapljivih spojeva. Analizirani spojevi, podijeljeni u 8 kemijskih grupa, značajno su utjecali na senzorni profil vina i njihovu različitost. Rezultati su pokazali značajan i pozitivan utjecaj korištenih sojeva kvasaca na neke grupe spojeva koji doprinose kakvoći vina, poput etil estera, izoamil i izobutil acetata, nekih viših alkohola te monoterpena (linalol, citronelol i geraniol). Određena je i aktivna mirisna vrijednost pojedinih aromatskih spojeva (OAV) koji su prema sličnosti deskriptora grupirani u aromatske serije poput voćne, cvjetne, začinske i maslačne, što je omogućilo i opisno definiranje aromatskog profila svakog vina.

Ključne riječi: ´Chardonnay´, *Saccharomyces cerevisiae*, GC-MS, aromatski spojevi, OAV

Chemical and sensory characterization of Chardonnay wines

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Abstract

During the vintage 2017. four wines obtained by fermenting Chardonnay musts with commercial starter cultures of *Saccharomyces cerevisiae* yeast strains were compared in terms of their volatile aroma compounds composition. An easy handle methodology, Solid Phase Extraction Gas Chromatography Mass Spectrometry-based, enabled the identification of almost 80 volatile compounds. These aroma compounds, arranged in eight chemical groups strongly influenced the sensory profile of each wine allowing their differentiation. The results revealed marked influence and positive contribution of yeast strains that were used on several wine quality contributors such as ethyl esters, isoamyl and isobutyl acetate, some higher alcohols and monoterpenes like linalool, citronellol and geraniol. Odor activity value of aroma compounds (OAV) was determined and by grouping the once with similar descriptors into aromatic series such as fruity, floral, spicy and buttery a descriptive organoleptic profile of each wine was established.

Key words: Chardonnay, *Saccharomyces cerevisiae*, GC-MS, aromatic compounds, OAV

Utjecaj duljine trajanja maceracije i odvajanja sjemenki na kemijski sastav i kakvoću vina sorte 'Plavac mali' (*V. Vinifera L.*)

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Sažetak

Plavac mali najvažnija je autohtona crna sorta Hrvatske. Zbog iznimno visokog sadržaja polifenolnih spojeva u grožđu odavna je predmet različitih znanstvenih istraživanja. Poznato je da uz brojne čimbenike na sadržaj ukupnih polifenola u vinu Plavca malog najznačajnije utječe duljina trajanja maceracije masulja, odnosno intenzitet oslobađanja polifenola iz sjemenki. U ovom istraživanju primjenjena su tri različita vremenska intervala trajanja maceracije, prvi standardni interval od 8 dana kao kontrolna varijanta, drugi interval u trajanju od tri tjedna te treći interval u trajanju od sedam tjedana. Pri tome je iz dva uzorka masulja prije početka vrenja odvojeno cca 80-85% sjemenki uz trajanje maceracije također od tri, odnosno sedam tjedana. Rezultati fizikalno kemijske analize pokusnih vina u varijantama sa svim sjemenkama u masulju, pokazali su pravilnost povećanja sadržaja ukupnih polifenola produljenjem trajanja maceracije, dok se kod sadržaja ukupnih antocijana ta pravilnost potpuno gubi. U varijantama sa izdvojenim sjemenkama duljina trajanja maceracije nema utjecaja na sadržaj ukupnih polifenola kao niti na sadržaj ukupnih antocijana. Senzorička evaluacija pokusnih vina metodom rangiranja, pokazala je superiornost uzoraka varijanti sa odvajanjem sjemenki pri čemu je varijanta sedam tjedana maceracije u 55% slučajeva bila prvorangirana, a varijanta tri tjedna maceracije u 45% slučajeva. Najslabije rangirana, u 90% slučajeva bila je varijanta sedam tjedana maceracije sa svim sjemenkama, dok su se kontrolna varijanta i varijanta tri tjedna maceracije sa svim sjemenkama gotovo podjednako puta našle na trećem, odnosno četvrtom mjestu.

Ključne riječi: Plavac mali, maceracija, polifenoli, antocijani, odvajanje sjemenki

Influence of the maceration time lenght and the separation of seeds on the chemical composition and wine quality of 'Plavac mali' variety (*V. Vinifera L.*)

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Abstract

Plavac mali is the most important indigenous red variety in Croatia.The issue of the very high content of polyphenol compounds in grape has long been a subject of various researches. It is known that, with many other factors, the most direct and most significant influence on the content of polyphenol compounds in the wine Plavac mali depends on the lenght of the maceration of marc or, most importantly, the intensity of the release of polyphenols from grape seeds. The first is the usual, standard interval of eight days which is used as a control variable, the second of three weeks and the third interval of seven weeks. During this time, approximately 80-85% of grape seeds were removed from two samples of marc before fermentation with the duration of maceration being three and seven weeks. The results of the physical and chemical analysis of test wines with all of the grape seeds in marc showed a regularity in the increase of the overall content of polyphenols the longer the maceration process lasted. When it comes to the overall content of anthocyanins, that regularity is completely lost. In samples with extracted grape seeds , the lenght of maceration has no influence on the overall content of polyphenols and anthocyanins. The sensory evaluation of test wines using the method of ranking showed an superiority of samples with the grape seeds extracted during which the sample with seven weeks of maceration was ranked best in 55% of the cases and the sample with three weeks of maceration in 45% of the cases. The worst ranked sample, in 90% of the cases, was the one with seven weeks of maceration with all of the grape seeds present. The control variable and the sample with three weeks of maceration and all of the grape seeds present were almost evenly ranked third and fourth.

Key words: Plavac mali, maceration, polyphenols, anthocyanins, seeds separation

Usporedba krioprezervacijskih metoda u preživljavanju i regeneraciji sorte vinove loze "Portan" (*Vitis vinifera L.*)

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Sažetak

Vinova loza je jedna od gospodarski najvažnijih poljoprivrednih kultura u svijetu te se zbog toga posvećuje velika pažnja njenom razmnožavanju i dugoročnom očuvanju. Krioprezervacija je *in vitro* metoda pohrane biljnog materijala u tekućem dušiku pri niskim temperaturama (-196°C) koje svojim inhibirajućim djelovanjem uvjetuju zaustavljanje metaboličkih funkcija biološkog materijala te tako omogućuju njegovu dugoročnu pohranu. Bogati i raznoliki sortiment vinove loze uvjetovao je različite reakcije pojedinih sorata na utjecaje uzrokovane procesima krioprezervacije, a uspješnost metode ovisi i o primjeni odgovarajuće tehnike za određenu sortu. U ovom istraživanju testiraju se dvije nove tehnike V-cryo-plate i D-cryo-plate, bazirane na vitrifikaciji i dehidraciji, primjenom aluminijskih kriopločica. Istraživanje je provedeno na sorti "Portan" (*Vitis vinifera L.*) kao referentnoj sorti za in vitro uvjete, a dobiveni rezultati uspoređeni su s rezultatima standardne tehnike za krioprezervaciju vinove loze (D-V (droplet-vitrifikacija).

Ključne riječi: vinova loza, "Portan", krioprezervacija, aluminijske kriopločice

Comparison of cryopreservation methods in survival and regrowth of grapevine variety "Portan" (*Vitis vinifera L.*)

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Abstract

Grapevine is a worldknown crop plant and the great effort has been done in its propagation and a long-term storage. Cryopreservation *in vitro* is a method of plant material storage in liquid nitrogen (-196°C) where exposing plant material to these low temperatures inhibit all metabolic functions, thus enabling long-term storage. Distinctive and numerous grapevine varieties caused different reactions response to the effects caused by cryopreservation processes, and the success of the method also depends on the application of the appropriate technique for a particular variety. In this study, two new cryopreservation techniques were tested V-cryo-plate and D-cryo-plate, based on vitrification and dehydration, using aluminium cryo-plates. The study was made on "Portan" variety (*Vitis vinifera* L.), as a referent variety for *in vitro* conditions, and obtained results were compared with results made with standard grapevine cryopreservation technique (D-V (droplet-vitrification).

Key words: grapevine, "Portan", cryopreservation, aluminium cryo-plates

Evaluacija vinskih destilata dobivenih od sorata 'Kraljevina' i 'Ranfol' (*Vitis vinifera* L.)

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Sažetak

Sorte vinove loze korištene u proizvodnji vinjaka vrhunske kvalitete, određene su specifičnim karakteristikama kao što su visoka ukupna kiselost, nizak sadržaj šećera i nizak pH. U kategoriju navedenih sorata može se svrstati nekoliko hrvatskih autohtonih sorata, kojima pripadaju 'Kraljevina' i 'Ranfol'. Posjedovanjem navedenih karakteristika, može ih se nazvati potencijalno prikladnim sortama za proizvodnju rakija od vina, osobito vinjaka. Cilj ovog rada je evaluacija karakteristika vinskih destilata od sorata 'Kraljevina' i 'Ranfol' i procjena njihove prikladnosti za proizvodnju rakija od vina i vinjaka u Republici Hrvatskoj. Berba i alkoholna fermentacija provedeni su na vinogradarsko-vinarskom pokušalištu „Jazbina", a destilacija u laboratoriju Zavoda za vinogradarstvo i vinarstvo Agronomskog fakulteta u 2017. godini. Provedena je analiza kemijskog sastava vina te analiza kemijskog sastava srednjeg toka destilata prema propisanim metodama O.I.V.-a. Određivanje hlapivih spojeva kao viših alkohola, estera, metanola i acetaldehida provedeno je metodom plinske kromatografije s plameno-ionizacijskim detektorom. Prema osnovnim kemijskim parametrima određenim u srednjem toku destilata zaključak je kako sorte 'Kraljevina' i 'Ranfol' sadrže potrebne karakteristike koje ih čine prikladnim za proizvodnju vinjaka. Zadani cilj te dobiveni rezultati su vrlo načajni za poticanje šire uporabe navedenih sorata za ovu namjenu.

Ključne riječi: vinjak, 'Kraljevina', 'Ranfol', hlapivi spojevi

Evaluation of wine distillates from grapevine varieties ‘Kraljevina’ and ‘Ranfol’ (*Vitis vinifera* L.)

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Abstract

The grapevine varieties used in the production of high quality brandy, are determined by specific characteristics such as high total acidity, low sugar content and low pH. Several Croatian autochthonous varieties, like 'Kraljevina' and 'Ranfol', can be classified in the mentioned category. These varieties can be called potentially suitable for the production of wine brandies. The main aim of this research is to evaluate the characteristics of wine distillates obtained by ‘Kraljevina’ and ‘Ranfol’ varieties and to estimate their suitability for the production of wine brandies in Republic of Croatia. Grape harvest and alcoholic fermentation were carried out on the experimental vineyard "Jazbina", and distillation in the laboratory of the Department for Viticulture and Oenology of the Faculty of Agriculture in 2017. The chemical analysis of the wine, and analysis of the chemical composition of ‘the heart’ of distillates were performed according to O.I.V. methods. Determination of the volatile compounds of distillates like higher alcohols, esters, methanol and acetaldehyde was performed by gas chromatographic method with flame ionization detector. Conclusion is that the grapevine varieties 'Kraljevina' and 'Ranfol' contain the necessary characteristics that make them suitable for the production of wine brandies, according to the chemical parameters determined in ‘the heart’ of the distillates. The given goal and obtained results have great importance to encourage the widespread use of these varieties for this purpose.

Key words: Brandy, 'Kraljevina', 'Ranfol', volatile compounds

Karakterizacija vina Kastafska Belica

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Sažetak

Regija primorska Hrvatska kao i ZOI Hrvatsko primorje bogato je autohtonim sortama vinove loze. Mnoge od njih su gotovo nestale, kao što su i autohtone sorte Kastavštine čijom kupažom nastaje Kastafska Belica. Stoga je provedena ukupna karakterizacija vina Kastafska Belica, pri čemu su se analizirali standardni fizikalno-kemijski parametri: alkoholna jakost, reducirajući šećeri, pepeo, pH vrijednost, ukupna kiselost, hlapive kiseline, slobodni sumporni dioksid, ukupni sumporni dioksid te je dodatno određen i sadržaj fenolnih komponenti tekućinskom kromatografijom spregnutom s tandem masenim detektorom (LC-MS/MS). Potvrda standardnih fizikalno-kemijskih parametara provedena je uz pomoć Fourier-transform infracrvene spektroskopije (FTIR). Analizirano je ukupno 13 uzoraka vina Kastafska Belica. Sva analizirana vina prema fizikalno-kemijskim parametrima udovoljavaju zahtjevima za kvalitetno vino proizvedeno u ZOI Hrvatsko primorje. Rezultati FTIR analize, koja je služila kao potvrdna metoda za analizu standardnih fizikalno-kemijski parametara, pokazali su varijacije među vinima za mjerene parametre, ali na neznatnoj razini. Nadalje, analiza fenolnog sastava vina je pokazala širok spektar detektiranih fenolnih komponenti gdje su najzastupljeniji fenoli bili flavonoidi iz flavan-3-ol skupine. U nekim je uzorcima detektirana oksidacija vina popraćena smanjenom količinom fenolnih komponenti. Dobiveni ukupni rezultati pokazuju visok potencijal vina Kastafska Belica, ali i daju temelj za daljnje analize i unapređenje procesa proizvodnje.

Ključne riječi: vino, Kastafska Belica, polifenoli, autohtone sorte grožđa

Characterization of the Kastafska Belica wine

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Abstract

Coastal region of Croatia is rich in autochthonous grape varieties. Many of them have almost been extincted such as for example the autochthonous varieties of Kastav, used for the production of the Kastafska Belica wine. Therefore, we decided to characterize the Kastafska Belica wine by assessing the standard physicochemical profile parameters: alcohol content, reducing sugars, ashes, pH value, total acidity, volatile acidity, free sulfur dioxide and total sulfur dioxide. Additionally, we determined phenolic components in wine by liquid chromatography coupled to tandem mass detector (LC-MS/MS). Fourier-transform infrared spectroscopy (FTIR) was performed as a confirmation method for the determination of standard physicochemical parameters. A total of 13 Kastafska Belica wines samples were analyzed. All analyzed wines met the requirements for quality wine produced in the ZOI Croatian coastal region according to the measured physico-chemical parameters. The results of FTIR analyzes have shown an inter-wine variability for measured parameters, but at negligible level. Furthermore, the phenolic composition of wines showed a wide spectrum of phenolic components detected, where the most prominent phenols were flavonoids from the flavan-3-ol group. In some samples the oxidation was detected as well substantiated by reduced amounts of phenolic components. The overall results obtained show a high potential of Kastafska Belica wine and provide a basis for additional analyzes and improvement of the production process.

Key words: wine, Kastafska Belica, polyphenols, autochthonous grape varieties

Usporedba *in vitro* i *in vivo* evaluacije osjetljivosti sorata vinove loze na plamenjaču (*Plasmopara viticola*)

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Sažetak

U svijetu se provode brojni oplemenjivački programi vinove loze s ciljem dobivanja sorata otpornih na gljivične bolesti. Osnova su često autohtone sorte da bi se što više sačuvala prepoznatljivost određenog područja. Hrvatska broji više od stotinu autohtonih sorata međutim ne postoje istraživanja o njihovoj osjetljivosti na plamenjaču što je preduvjet za daljnje oplemenjivanje. Cilj ovog istraživanja je usporediti dvije najraširenije metode koje se koriste u procjeni osjetljivosti sorata vinove loze: *in vivo* (poljski pokus) i *in vitro* korištenjem metode lisnih diskova. Istraživanje je provedeno na devet genotipova: sedam autohtonih sorata, 'Cabernet sauvignon' i *Vitis riparia*. *In vivo* simptomi bolesti praćeni su nakon cvatnje u četiri navrata s vremenskim razmakom od dva tjedna, a kod lisnih diskova evaluacija je provedena u jednom terminu na listovima različite starosti (1.-7. list od vrha mladice). Utvrđene su značajne razlike u osjetljivosti između ispitivanih genotipova korištenjem obje metode. Korištenjem metode *in vivo* utvrđene su značajne razlike između sorata vinove loze u početnim terminima, dok su kasnije razlike smanjene što upućuje na utjecaj genotipa na različitu brzinu razvoja bolesti. Kod *in vitro* metode uz razliku u genotipovima utvrđena je značajna razlika osjetljivosti listova različite starosti. Najviša razina povezanosti rezultata dviju metoda (r>0,5) utvrđena je između trećeg termina *in vivo* te 3. do 6. lista (od vrha mladice) u *in vitro* uvjetima.

Ključne riječi: vinova loza, plamenjača, autohtone sorte

Comparison of *in vitro* and *in vivo* evaluation of grapevine varieties to downy mildew susceptibility (*Plasmopara viticola*)

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Abstract

Numerous grapevine breeding programs are carried out in the world with the aim of getting varieties resistant to fungal diseases. The basics are often native varieties in order to preserve the authenticity of a certain area. Croatia counts more than a hundred native varieties but there is no research on their downy mildew susceptibility, which is essential for further breeding. The aim of this study is to compare the two most widely used methods for estimating the susceptibility of grapevine varieties: *in vivo* (field trial) and *in vitro* using the leaf disk assay. The research was conducted on nine genotypes: seven native varieties, Cabernet Sauvignon and *Vitis riparia*. *In vivo* disease symptoms were monitored after flowering four times in two-week intervals, and the leaf disks were evaluated once on the leaves of different developmental stages (from the 1st to 7th leaf from the shoot tip). Significant differences in susceptibility between the examined genotypes were found using both methods. By using the *in vivo* method significant differences were noticed during the initial terms, while the differences were reduced later on suggesting that the rate of disease development is peculiar to the genotype. *In vitro* method showed, together with differences between the genotypes, significant differences between the leaves of different developmental stages. The highest level of correlation between the results of these two methods (r>0,5) was determined between the third term *in vivo* and the 3rd to the 6th leaf (from the shoot tip) in *in vitro* conditions.

Key words: Grapevine, Downy mildew, Native varieties

Utjecaj rane defolijacije i prorjeđivanja grozdova na kvalitetu grožđa sorte 'Moslavac' (*Vitis vinifera* L.)

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Sažetak

Sorta 'Moslavac' smatra se hrvatskom autohtonom sortom. Zbog tanke kožice, meke bobice, bujnosti, sorta je osjetljiva na sivu plijesan, pa bi ju trebalo uzgajati na prikladnim vinogradarski položajima, a ampelotehničkim zahvatima kontrolirati prinos i mikroklimu trsa. Cilj ovoga rada je utvrditi utjecaj ampelotehničkih zahvata, rane defolijacije i prorjeđivanja grozdova, na kvalitetu grožđa sorte 'Moslavac'. Istraživanje je provedeno u pokusnom nasadu u Svetom Urbanu (podregija Zagorje- Međimurje) sa dvije varijante, kontrola u kojoj nisu provedeni ampelotehnički zahvati, te varijanta sa provedenim zahvatima rane defolijacije i redukcije prinosa. Oba ampelotehnička zahvata provedena su istovremeno, neposredno nakon cvatnje. Zahvatom defolijacije uklonjeni su listovi u zoni grozdova, a prorjeđivanjem grozdova prinos je reduciran na jedan grozd po mladici. Nakon šare praćena je dinamika dozrijevanja, mjerenjem ukupne kiselosti i sadržaja šećera, a u punoj zrelosti određen je prinos i sadržaj pojedinačnih organskih kiselina. Utvrđen je značajno viši sadržaj šećera kod varijante sa ranom defolijacijom i prorjeđivanjem grozdova, a ujedno kod navedene varijante nije bilo prisutnih simptoma sive plijesni. Nije utvrđena značajna razlika u ukupnoj kiselosti, kao ni sadržaju pojedinačnih organskih kiselina. Iz dobivenih rezultata može se zaključiti kako rana defolijacija i prorjeđivanje grozdova najviše utječu na dinamiku nakupljanja šećera, dok na ukupnu kiselost nemaju značajnijeg utjecaja.

Ključne riječi: Moslavac, rana defolijacija, prorjeđivanje grozdova, kvaliteta

Effect of early defoliation and grape thinning on grape quality of cv. Moslavac (*Vitis vinifera* L.)

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Abstract

Cultivar Moslavac is considered as Croatian native cultivar. Because of its thin skin, soft berries and high vigour, the cultivar is susceptible to Botrytis, thus it should be planted on suitable vineyard sites and the canopy management operations should be used to control yield and vine microclimate. The aim of this work is to determine the effect of canopy management operations, early defoliation and grape thinning, on grape quality of cultivar Moslavac. The research was conducted in experimental vineyard in Sveti Urban (region Zagorje- Međimurje) with two treatments, control with none canopy management operations conducted and treatment with conducted early defoliation and grape thinning. Both operations were carried out at the same time, just after flowering. The defoliation was carried out removing all leaves in the fruiting zone, while grape thinning was carried out leaving just one grape bunch per shoot. After vérasion the ripening was monitored by measuring content of sugar and total acidity, while in full ripeness the yield and organic acids were determined. The higher content of sugars was determined at the treatment with early defoliation and grape thinning. Furthermore, the mentioned treatment did not show symptoms of Botrytis. There was no significant difference between treatments considering total acidity and the content of organic acids. It can be concluded that early defoliation and grape thinning had the greatest impact on sugar accumulation and very small impact on total acidity.

Key words: Moslavac, early defoliation, grape thinning, quality

Tradicionalni izrazi kao čimbenik prepoznatljivosti kakvoće vina na tržištu

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Sažetak

Oznake kakvoće hrvatskih vina „kvalitetno“ i „vrhunsko“ utemeljene su na fizikalno kemijskim i senzornim parametrima i ulaskom Hrvatske u EU postale su tzv. tradicionalni izrazi. Deklariranje tradicionalnih izraza na etiketi nije obvezno, ali je i dalje regulirano na vrlo precizan način. Obzirom da su izrazi kvalitetno i vrhunsko dio tradicije deklariranja vina, stare preko pedeset godina, neupitan je interes struke o njihovoj važnosti u deklariranju i izboru vina na tržištu. Hrvatski vinari koriste pravo dragovoljnog označavanja tradicionalnih izraza što posljedično zahtijeva dodatno educiranje potrošača, obzirom na različite načine prezentiranja vina i kakvoće. Cilj ovog istraživanja bio je dobiti informacije o utjecaju deklariranih oznaka na izbor vina, s naglaskom na tradicionalne izraze, te stavove potrošača u odnosu na kakvoću vina i deklariranje. U istraživanju, provedenom online upitnikom, sudjelovalo je preko 250 sudionika, potrošača i proizvođača vina. Provedena je i analiza medija, s ključnim riječima kvalitetno vino i vrhunsko vino. Većina proizvođača zadovoljna je tradicijom i korištenjem tradicionalnih izraza. Čimbenici izbora vina na tržištu rangirani su sukladno socioekonomskoj pripadnosti anketiranih sudionika. Udio anketiranih potrošača koji razumiju deklarirane izraze značajan je, ali su u konačnom izboru ograničeni cijenom vina. Prezentiranje vina kroz medije, tradicionalnim izrazima kvalitetno i vrhunsko, neupitan je izvor dobrobiti za proizvođače. Deklariranje tradicionalnih izraza predstavlja komunikaciju koju potrošači prihvaćaju s povjerenjem.

Ključne riječi: tradicionalni izrazi, deklariranje, tržište, vino

Traditional terms as a wine quality marker in the market

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Abstract

Quality labels of Croatian wines „quality" and „top quality" are based on chemical and sensory parameters and became so called traditional terms after Croatia's join to the EU. Declaring of traditional terms on the label is not mandatory, but is still regulated in a very precise way. Considering the tradition of quality labeling longer than fifty years, the interest of professionals in relation to importance of those terms in the market is unquestionable. Croatian winemakers use the right of voluntary labeling of traditional terms, so this requires additional consumer education because of different ways of presenting wine and quality.

The aim of this research was to obtain information how the choice of wine was influenced by the declared terms, with emphasis on traditional terms, and consumer attitudes in terms of wine quality and declaration too. The research was conducted with online questionnaire. More than 250 participants, consumers and winemakers completed the questionnaire. Media research, with key words „quality" wine and „top quality" wine, was also carried out. The most of producers are satisfied with tradition and traditional terms in wine labeling. Wine market choice factors were ranked according to the socioeconomic affiliation of participants in research. The share of respondents who understand the declared terms is significant, but they are limited by the price of the wine. Presenting wine through the media with traditional terms quality and top quality is an unquestionable source of wellbeing for the producers. Declaring traditional terms is the communication in which consumers are confident.

Key words: traditional terms, declaring, market, wine

Utjecaj podloge na aromatski profil grožđa sorte 'Graševina' (*Vitis vinifera L.*)

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Sažetak

Graševina je najvažnija sorta vinove loze u Hrvatskoj sa udjelom od 23% u ukupnim površinama pod vinogradima. U proizvodnim nasadima kontinentalne Hrvatske ova sorta se najčešće uzgaja na dvije podloge: *Vitis berlandieri* x *Vitis riparia* Kober 5BB i *Vitis berlandieri* x *Vitis riparia* SO4. Navedene podloge svojim karakteristikama bitno utječu na bujnost, prinos i kvalitetu grožđa sorata vinove loze, dok njihov utjecaj na primarne arome u grožđu nije značajno istraživan, posebno u kontekstu predmetne sorte. Cilj ovog rada bio je utvrditi utjecaj dviju podloga (Kober 5BB i SO4) na sadržaj aromatskih spojeva u grožđu sorte 'Graševina'. Istraživanje je provedeno u pokusnom nasadu klonskih kandidata cv. Graševina izdvojenih u postupku individualne klonske selekcije cijepljenih na dvije podloge Kober 5BB i SO4 kroz dvije godine 2015. i 2016. Pokusni nasad nalazi se na lokaciji Radovanci (vinogorje Kutjevo). Provedena je analiza sastava i koncetracije aromatskih spojeva odgovornih za primarnu sortnu aromu lociranih u kožici grožđa putem vezanog sustava plinska kromatografija-spektrometrija masa (GC-MS). Utvrđeno je kako u profilu aromatskih spojeva u grožđu predmetne sorte dominiraju aldehidi, masne kiseline, esteri, alkoholi, te terpeni koji su posebno značajni kao nosioci primarne arome vina. Utvrđen je značajan utjecaj podloge na sve istraživane grupe aromatskih spojeva.

Ključne riječi: grožđe, klonska selekcija, aromatski spojevi, primarne arome, GC-MS

Influence of the rootstock on the aromatic profile in grapes of Graševina cv. (*Vitis vinifera L.*)

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Abstract

Graševina is the most important grape variety in Croatia, with the 23% of the total area under vineyards. In the vineyards of continental Croatia it is usually grown on two *Vitis berlandieri* x *Vitis riparia* rootstocks Kober 5BB and SO4. These two rootstocks have a significant influence on the vine vigor, yield and grape quality of vine varieties, while their influence on the primary aroma in grapes has not been significantly researched, especially in the context of the Graševina variety. The aim of this paper was to determine the influence of two rootstocks (Kober 5BB and SO4) on the content of aromatic compounds in grapes of the Graševina variety. The research was conducted in the experimental vineyard of clonal candidates cv. Graševina selected in the individual clone selection procedure grafted on two rootstock Kober 5BB and SO4 during two harvest years 2015 and 2016. Experimental vineyard is located at Radovanci (Kutjevo wine region). Analysis of content and concentration of aromatic compounds responsible for the varietal aroma profile that are located in grape skin was done by gas chromatography coupled with mass spectrometry (GC-MS). It has been found that in the profile of aromatic compounds in grape of the subject variety are dominated by aldehydes, fatty acids, esters, alcohols and terpenes which are particularly important as carriers of varietal aroma. Significant influence of the rootstock on all the investigated groups of aromatic compounds was determined.

Key words: grape, clonal selection, aromatic compounds, varietal aroma, GC-MS

Differential affinity of bentonite towards pathogenesis-related proteins depending on the time of addition during fermentation of Malvazija istarska grape must

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Abstract

The grape pathogenesis-related thaumatin-like proteins (TLP) and chitinases are the major soluble proteins in grape juice and are considered responsible for haze formation in white wines. Bentonite is still the most efficient and cost-effective agent for their removal. In this work, the differential affinity of bentonite towards pathogenesis-related proteins was investigated, with respect to the time of addition at various stages of fermentation of Malvazija istarska (*Vitis vinifera* L.) must in order to possibly reduce the total dosage required. Five treatments were established, with an initial bentonite dose of 100 g/hL added in clear must (MU), at the beginning (BE), in the middle (MD), and at the end of fermentation (EN), while control (CO) received no bentonite. After fermentation, protein-stable wines were obtained by additional bentonite fining. Proteins were determined by reversed-phase high-performance liquid chromatography (HPLC-DAD). Four TLPs and two chitinases were tentatively identified. All the treatments reduced both groups of proteins. MD and especially EN treatments were characterised by the highest affinity of bentonite towards particular TLP proteins, while the time of bentonite addition did not influence the removal of chitinases. MD and EN turned out to be the most effective among the treatments and reduced the required total bentonite amount for 19 and 21 %, respectively.

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Key words: pathogenesis-related proteins, bentonite, fermentation, Malvazija istarska, protein stability

Utjecaj folijarne gnojidbe na pH vrijednost mošta cv. Malvazije istarske (*Vitis vinifera L.*)

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Sažetak

Malvazija istarska (*Vitis vinifera L.*) smatra se autohtonom istarskom sortom i jedna je od najznačajnijih bijelih sorata u Hrvatskoj. Potražnja za vinima ove sorte sve više raste, jer su njezinu kvalitetu prepoznali mnogi potrošači kako Hrvatske, tako i cijeloga svijeta. Domaći porizvođači u Istri sve češće biraju ovu sortu i kao bazu za proizvodnju pjenušavih vina, koja su izuzetno popularna tokom turističke sezone. No, kako Istru karakterizira mediteranska klima, a najzastupljenije tlo je crvenica, vina od Malvazije istarske najčešće imaju povišenu pH vrijednost. Jedan od razloga je i previsoka količina kalija u tlu koji negativno utječe na pH vrijednost mošta. Kako je pH vrijednost važan parametar u proizvodnji baznog vina i poželjno je da bude što niži, pretpostavlja se da bi ga se moglo smanjiti folijarnom primjenom Mg zbog međusobnog antagonističkog odnosa ta dva iona. Ukupna kiselost i pH međusobno su povezani, a direktno utječu na svježinu i potencijal starenja baznoga vina i pjenušaca. Stoga je cilj ovog istraživanja bio utvrditi utječe li folijarni tretman s Mg na pH vrijednost u moštu. Dvogodišnji pokus postavljen je 2013. i 2014. godine, s četiri gnojidbena tretmana u tri ponavljanja (NPK, NPK + Agromag (6% MgO), NPK + Agromag + Fosforo(30% P205) i NPK + Agromag + Fosforo + Bio Prot). Značajni utjecaj postignut je sa tretmanima NPK + Agromag + Fosforo i NPK + Agromag + Fosforo + Bio Prot. Sveukupno određena pH vrijednost u moštu bila je od 3,00 do 3,23.

Ključne riječi: folijarna gnojidba, pH vrijednost, Malvazija istarska (*Vitis vinifera L.*), bazna vina, pjenušava vina

Effect of foliar fertilization on pH value of Istrian malvasia must (*Vitis vinifera* L.)

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Abstract

Istrian Malvasia (*Vitis vinifera L.*) is considered an autochthonous Istrian variety and is one of the most important white varieties in Croatia. The demand for wine from this variety is growing because its quality is recognized by many consumers in Croatia and around the world. Because of this, domestic producers in Istria increasingly choose this variety and as a base for sparkling wines, which is extremely popular during the tourist season. Mediterranean climate is characteristic for Istria, and the most common ground is red soil, so wines of Istrian Malvasia generally have an elevated pH value. One reason is the excessive amount of potassium that negatively affects the pH value. Since pH value is an important parameter in the production of base wine and is desirable to be as low as possible, it is assumed that it could be reduced by foliar application of Mg due to the mutual antagonistic relationship of the two ions. pH value directly affects total acidity, along with freshness and potential of aging of base wine and sparkling wine. Therefore, the aim of this reserch was to determine whether foliar treatment with Mg affects pH value in must. Two-year trial (2013 and 2014) was set up in Višnjan with four treatmans in three repetition (NPK, NPK + Agromag (6% MgO), NPK + Agromag + Fosforo (30% P205) and NPK + Agromag + Fosforo + Bio Prot). The measured pH ranges from 3.00 to 3.23, and the lowest pH value was achieved with NPK + Agromag + Fosforo treatment.

Key words: foliar fertilization, pH value, Istrian Malvasia (*Vitis vinifera L.*), base wine, sparkling wine

Vinogradarske zone u Republici Hrvatskoj

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Sažetak

Vinogradarstvo i vinarstvo među najvažnijim su poljoprivrednim i gospodarskim djelatnostima u Hrvatskoj. Vinova loza (Vitis vinifera L.) klimatski je osjetljiva kultura, jer na njen rast i razvoj uvelike utječu prevladavajući atmosferski uvjeti. Optimalni klimatski uvjeti za rast vinove loze ograničeni su zemljopisno, te se uobičajeno smatra da su najpogodnija područja za njezin uzgoj između 30° i 50° paralele sjeverne i južne geografske širine. Gledajući kroz sektor vinogradarstva i vinarstva, agroklimatski indeksi su metode kojima se određuju zemljopisna područja i njihova pogodnost za uzgoj određene sorte vinove loze, a pomoću njih se izrađuju karte vinogradarskih područja. Utjecaj klime na vinogradarsko zoniranje procijenjen je na temelju projekcija vrijednosti agroklimatskih indeksa poput Huglinovog indeksa, indeksa sume efektivnih temperatura prema Winkleru, indeksa hladnih noći i indeksa prosječne temperature zraka u vegetaciji. U Hrvatskoj je prva podjela na vinogradarske zone vezana uz izradu regionalizacije vinogradarskih područja početkom 70-tih godina 20. stoljeća. Tadašnja podjela vinogradarskih zona napravljena je sukladno međunarodnim standardima i preporukama OIV-a te Lisabonskom sporazumu iz 1958. godine, a prema kojima su „zone proizvodnje rezultat prirodnih čimbenika i pri čemu klimatske prilike igraju prvenstvenu ulogu". Prema sumi efektivnih temperatura, današnja vinorodna područja u Europi podijeljena su na klimatske zone: A,B,C I, C II, C IIIa i C IIIb. Ulaskom Hrvatske u Europsku uniju, vinogradarske zone u Hrvatskoj podijeljene su na B,C I i C II zonu. Rezultati najnovijih istraživanja te izračuni modela za projekciju buduće klime ukazuju na prisutnost klimatskih promjena i značajan porast temperature zraka, što podupire hipotezu o nužnosti revidiranja svih vinogradarskih zona u Hrvatskoj.

Ključne riječi: klima, vinova loza, agroklimatski indeksi, vinogradarske zone

Vineyard zoning in Croatia

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Abstract

Viticulture and enology are among the most important agricultural and economic activities in Croatia. Grapevines (Vitis vinifera L.) are a climate sensitive crops, because its growth and development are greatly influenced by the prevailing atmospheric conditions. The optimum climatic conditions for grapevine production are geographically limited, with commonly considered suitable areas for its production being between 30 ° and 50 ° of the north and south latitudes. In the viticulture and winemaking sector, agro-climatic indices are methods used to determine the geographical areas and their suitability for cultivating a particular grape variety, and are also commonly used to create maps of vineyard areas. The influence of climate on vineyard zoning was assessed on the basis of calculated values of agroclimate indexes such as Huglin's index, index sum of the effective temperatures according to Winkler, cold night index and the average air temperature index in the vegetation. In Croatia, the first division of vineyard zones was done as part of the regionalization of wine-growing areas in the 1970s. The division of wine-growing zones was done according to the international standards and recommendations of the OIV and the 1958 Lisbon Agreement. According to them, "production zones are a result of natural factors, with climatic conditions playing a prime role". According to the sum of the effective temperatures, todays vineyards in Europe are divided into climatic zones: A, B, CI, C II, C IIIa and C IIIb. When Croatia joined the European Union the vineyards in Croatia were divided into B, C I and C II zones. The results of the latest research and the calculations of the model for future climate projection indicate the presence of climate change and a significant increase in air temperature, supporting the hypothesis of the need to revise all the vineyard zones in Croatia.

Key words: climate, grapevine, agroclimatic indices, viticultural zones

Nove analitičke tehnike i metode kao mogućnost utvrđivanja autentičnosti vina

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Sažetak

Autentičnost vina stalno je područje interesa različitih znanstvenih disciplina čiji je zajednički cilj osigurati povjerenje u proizvod i sigurnost u deklarirane informacije. Najvažniji čimbenici koji definiraju autentičnost vina su sortnost, berba i zemljopisno područje proizvodnje grožđa. Tijekom godina razvijene su brojne tehnike za dokazivanje autentičnosti, a uspješnost njihove primjene ovisi prvenstveno o kemijskim parametrima koji ne podliježu promjenama tijekom proizvodnje ili ih je teško krivotvoriti. U utvrđivanju autentičnosti sortnog sastava i zemljopisnog podrijetla vina koriste se analize profila različitih grupa kemijskih spojeva i brojne analitičke tehnike, poput hlapivih spojeva i plinske kromatografije s masenim detektorom (GC-MS), polifenolnog, amino kiselinskog i proteinskog sastava i tekućinske kromatografije visoke učinkovitosti s masenim detektorom (HPLC-MS), mineralnog profila i induktivno spregnute plazme s masenim detektorom (ICP-MS), stabilnih izotopa i nuklearne magnetske rezonance (NMR) i masenog spektrometra za određivanje izotopnog omjera (IRMS), te multifaktorijalnih statističkih metoda (PCA, DA, CA, CLA).
Upravo kombiniranje rezultata specifičnih analitičkih tehnika s multivarijatnom statističkom analizom obećavajući je alat za razlikovanje vina u odnosu na sortu, berbu ili zemljopisno područje.

Ključne riječi: autentičnost, analitičke tehnike i metode, vino

New analytical techniques and methods as a possibility of wine authenticity assessing

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Abstract

The authenticity of wine is permanent field of interest of different sciences, which common goal is to ensure product confidence and safety in the declared information. The most important factors defining the authenticity of wine are grape variety, vintage and geographical origin of grape production. Numerous techniques have been developed to assess the authenticity over the time, and the success of their use depends primarily on the chemical parameters and compounds that do not undergo changes during the production process or are difficult to falsify. The modern analytical techniques and analysis of the profiles of various groups of chemical compounds are used as a markers in determination of the authenticity of the variety and the geographical origin of wine, such as volatile compounds and gas cromatography GC, poliphenolic, amino acid and protein profile with different high performance liquid chromatography HPLC, elemental composition with inductively coupled plasma mass spectrometry ICP-MS, stabile isotopes fingerprints with nuclear magnetic resonance spectroscopy NMR and isotope ratio mass spectrometry IRMS, and also multivariate analysis (chemometrics, PCA, DA, CA, CLA) in interpretation of analytical data. The results of specific analytical techniques combined with multivariate statistical analysis is promising tool for differentiating wines in regards to variety, vintage or geographic origin.

Key words: authenticity, analytical techniques and methods, wine

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Zbornik sažetaka

Voćarstvo

Mineral content in the leaves of young plum trees grafted on 'Docera 6' rootstock

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Abstract

An experimental orchard of plum (*Prunus domestica* L.) trees was planted in the autumn of 2016 at the Fruit Growing Institute - Plovdiv, Bulgaria. Objects of the present study were two plum cultivars – 'Jojo' and 'Topgigant Plus' grafted on the clonal rootstock 'Docera 6'. The observations were conducted during the period 2017 - 2018. As a standard for comparison, the same cultivars grafted on the rootstock *Prunus cerasifera* L. were used. Increasing amounts of ammonium nitrate (NH_4NO_3) - 260 kg ha^{-1}, 330 kg ha^{-1} and 400 kg ha^{-1} were applied twice, in each experimental year. The aim of this research was to describe the dependence between the level of mineral nutrition and the main nutrients content (N, P, K, Ca, Mg and Fe) in the leaves of the tested plum rootstock combinations. The results obtained showed that the fertilization rate did not significantly affect the nitrogen content in the leaves of the plum trees in all rootstock combinations. The values for the nitrogen content in the leaves varied in range - 1.95 % - 2.49 %. The results regarding the content of the other elements did not show a clear tendency. The nutrients content in leaves was affected by the rootstock. The K content in the leaves was approximately twice higher for the trees grafted on 'Docera 6'. This was observed for both tested cultivars. For the elements Mg and Fe a reverse trend was observed. Their content was higher in the leaves of the grafted on *P. cerasifera* rootstock. The results of these initial investigations give a good base for further studies.

Key words: plum, rootstock, nitrogen fertilization, leaf analysis, mineral elements

Predatory arthropod in IPM and ecologically managed olive orchards: the impact on the strengths of trophic interactions

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Abstract

Understanding how changes in soil fauna diversity can affect ecosystem functions, with special concern on the trophic network interactions, is among key questions in ecology. Predatory arthropods that occupy higher trophic levels can be negatively affected by pesticides used in the field, directly or/and through reduction of prey. Our aim is to determine predator and prey diversity and abundance in two olive orchards characterized by different type of agricultural management (IPM or ecological) and to analyze predation in both field types. In order to see the differences in trophic interactions among invertebrate fauna (mollusks, earthworms, arthropods), complex sampling has been carried out through vegetation season in 2018. Extensive DNA barcoding of predators and potential prey will be provided, after which complex trophic network will be created using acquired metagenomic data. Biodiversity study has shown that the main predators in soil through late spring and summer were ground beetles (Coleoptera: Carabidae) and spiders (Arachnida: Aranea). On the other hand, in canopy layer dominant predators were spiders and harvestmen (Arachnida: Opiliones). The dominant prey were springtails (Collembola), Diptera, ants (Hymenoptera: Formicidae) and mites (Arachnida: Acarina). Differences in predatory fauna between study sites and impact of management type on predators' diversity in the field will be discussed with the purpose of improving biocontrol potential by predation.

Keywords: predatory arthropods, agricultural management type, olive orchard, trophic network

Suzbijanje jabukova savijača metodom konfuzije u Međimurju

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Sažetak

Jabukov savijač (*Cydia pomonella L.*) najvažniji je štetnik jabuke protiv kojega se godišnje primjenjuje između 8 i 10 tretiranja insekticidima. Obzirom na negativne učinke insekticida na okoliš i korisne organizme nastoji se smanjiti unos insekticida. Budući se smanjuje broj aktivnih tvari s dozvolom za primjenu, nastoji se u zaštitu jabuke uvesti druge mjere zaštite kao što su biološke i biokemijske. Cilj istraživanja bio je utvrditi učinkovitost metode konfuzije jabukova savijača kao osnovnu mjeru u odnosu na kemijsku zaštitu i učinkovitost metode konfuzije s dodatnim manjim brojem zaštita insekticidima u odnosu na kemijsku zaštitu. U dvogodišnjem istraživanju postavljeni su pokusi u voćnjaku Agromeđimurje d.d. Nadelišće tijekom 2017. i 2018. godine. Za konfuziju su korišteni raspršivači feromona Isomate C TT u dozi od 500 raspršivača po ha. Pokusne površine su iznosile 2ha u 2017. i 3ha u 2018. godini. U prvoj godini istraživanja u zaštiti od jabukova savijača primijenjena je samo konfuzija, a u drugoj godini uz konfuziju i 3 tretiranja insekticidima početkom vegetacije da bi se smanjila prezimljena populacija.

U prvoj godini istraživanja na konfuziji u berbi bilo je u prosjeku 5,5% napadnutih plodova, a na standardu uz 6 primjena insekticida 1,25%, u drugoj godini je postotak napadnutih plodova bio jednak od 0,5%. Može se zaključiti da je moguće zaštititi nasad jabuke od jabukova savijača ovom metodom uz dodatna 2 do 3 tretiranja insekticidima.

Ključne riječi: feromoni, jabuka, konfuzija, zaštita

Control of codling moth by mating disruption in Međimurje

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Abstract

The codling moth (*Cydia pomonella L.*) is the most important apple pest and is controlled by using insecticides 8 to 10 times a year. Due to the negative effects of insecticides on the environment and beneficial organisms it is adventageous to reduce its use in pest control. Since the number of permitted active substances decreases over time, other protective measures, such as biological and biochemical, are introduced in apple protection practice. The aim of the research was to determine the effectiveness of mating disruption as a basic protection method in relation to the chemical protection and the efficiency of mating disruption with an additional chemical control treatments in relation to the chemical control treatments. In a two-year study, experiments were conducted in the orchard of Agromeđimurje d.d. Nadelišće during the vegetation season of 2017 and 2018. Isomate C TT pheromone sprayers were used for disruption at a dose of 500 sprays per ha. Experimental plot of 2ha was set up in 2017 and 3ha experimental plot was set up in 2018. In the first year of research only mating disruption was applied for control of codling moth, and in the second year three additional insecticide treatments along with mating disruption were applied at the beginning of vegetation in order to reduce the overwintering pest population. In the first year of research at harvest time, there was an average of 5.5% damaged fruits on mating disruption plot and 1.25% damaged fruits on standard control plot (with 6 insecticide applications). In the second year of research the percentage of damaged fruits was equal (0.5%) on both plots. We can conclude that it is possible to protect the apple orchard of codling moth using mating disruption with additional 2 to 3 insecticide aplications during the season.

Key words: pheromones, apples, mating disruption, protection

Očuvanje i identifikacija tradicionalnih sorti jabuka iz kolekcijskog nasada HCPHS u Donjoj Zelini

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Sažetak

Hrvatska je zemlja s vrlo dugom tradicijom proizvodnje voća u kojoj autohtone i udomaćene sorte zauzimaju važno mjesto. Zavod za voćarstvo i povrćarstvo Hrvatskog centra za poljoprivredu, hranu i selo se 2014. uključio u Nacionalni program očuvanja i održive uporabe biljnih genetskih izvora za hranu i poljoprivredu u RH s ciljem inventarizacije i prikupljanja biljnih genetskih izvora i izgradnju kapaciteta za njihovo čuvanje, održavanje, regeneraciju, opis i procjenu svojstava primki. Tijekom 2016. i 2017. godine prikupljeni su uzorci lišća 145 genotipova jabuke iz kolekcijskog nasada u Donjoj Zelini za potrebe molekularne identifikacije sorti koja je izvršena upotrebom 12 mikrosatelitskih (SSR) biljega (CH04c07, CH01h10, CH01h01, Hi02c07, CH01f02, CH01f03b, GD12, GD147, CH04e05, CH02d08, CH02c11, CH02c09, europski standardni set dogovoren na razini ECPGR) u DNA Fingerprinting Service, NIAB EMR, UK. Podaci su dobiveni upotrebom Applied Biosystems 3110 Prism Genetic Analyzer i analizirani pomoću GENESCAN i GENOTYPER softverske aplikacije. Svi analizirani uzorci su uredno očitani i uspoređeni međusobno s više od 2000 genotipova jabuke iz baze genotipova koja je formirana iz tri kolekcijska nasada: National Fruit Collection, Tamar Valley Group i Irish Seed Savers Association. Na temelju dobivenih rezultata za 22 genotipa potvrđen je identitet, kod 19 genotipova utvrđeno je pravo ime sorte, za 54 genotipova utvrđeno je da su jedinstveni, 45 genotipova su bili duplikati, a za pet genotipova je utvrđeno da se ne radi o tradicionalnim sortama. Rezultati ovog istraživanja dali su jasniju sliku stanja tradicionalnog sortimenta jabuke u RH.

Ključne riječi: jabuka, tradicionalne sorte, kolekcijski nasad, molekularna identifikacija

Conservation and identification of traditional cultivars of apples from the collection orchard of ccafra in Donja Zelina

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Abstract

Croatia is a country with long tradition of fruit production in which autochthonous and domesticated cultivars are prominent. Institute of Pomology and Vegetable Crops of the Croatian Centre for Agriculture, Food and Rural Affairs has been involved in the National Programme for Preservation and Sustainable Use of Plant Genetic Resources for Food and Agriculture in the Republic of Croatia since 2014, with the aim to make an inventory off and collect plant genetic resources as well as to build capacity for preservation, maintenance, regeneration, description and evaluation of accessions. Leaf samples of 145 apple genotypes from the collection orchard in Donja Zelina for molecular identification of varieties were collected in 2016 and 2017, and DNA analysis, using 12 microsatellite (SSR) markers (CH04c07, CH01h10, CH01h01, Hi02c07, CH01f02, CH01f03b, GD12, GD147, CH04e05, CH02d08, CH02c11, CH02c09, the European standard set, agreed by ECPGR) was performed in the DNA Fingerprintig Service, NIAB EMR, UK. Data was generated using Applied Biosystems 3110 Prism Genetic Analyzer and with GENESCAN and GENOTYPER software applications were used to collect and analyse data. All of the samples gave a clear fingerprint and were compared to each other and against the 2000 apple genotype samples made up of accessions from the National Fruit Collection, Tamar Valley Group and Irish Seed Savers Association. Based on obtained results identity was confirmed for 22 genotypes, true name of the variety was determined in 19 genotypes, 54 genotypes were found to be unique, 45 genotypes were duplicates and five genotypes were identified not to be a traditional variety. The results of this study gave a clearer picture of the state of the traditional apple cultivars in the Republic of Croatia.

Key words: apple, traditional cultivars, collection orchard, molecular identification

Primjena Holcim Agrocal proizvoda u kalcizaciji nasada jabuka

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Sažetak

Provedena istraživanja imala su za cilj utvrditi učinkovitost Holcim Agrocal proizvoda Agrocal (Ca+Mg) i Agrocal (Ca) u neutralizaciji štetne kiselosti tla te njihovu učinkovitost na prirod i kvalitetu ploda jabuka, sorte 'Idared'. Poljski pokus postavljen je u razdoblju 2013.-2015. godine, na pseudoglejnom tipu tla, po slučajnom bloknom rasporedu sa 7 varijanti u 3 ponavljanja, na lokaciji Carevo selo, općina Barilović (Hrvatska). Prosječni uzorci tla uzeti su 5 puta iz sloja 0-30 i 30-60 cm (prvo uzorkovanje 13.12.2013. godine, prije tretmana, drugo u svibnju, treće u kolovozu, četvrto u listopadu 2014., a peto uzorkovanje u veljači 2015. godine), uzorci lišća 3 puta (u cvatnji, u fazi veličine plodova 4-5 cm i u berbi), te uzorci ploda u berbi u 2014. godini. Mineralni sastav ploda utvrđen je u neoguljenim plodovima. Pozitivan učinak na povećanje pH vrijednosti tla utvrđen je kod oba Holcim Agrocal proizvoda, s time da su nešto veća povećanja utvrđena kod varijanti tretiranih s Agrocal (Ca) u odnosu na Agrocal (Ca+Mg). U odnosu na mineralni sastav lista, Agrocal proizvodi imali su značajno jači utjecaj na mineralni sastav i kvalitetu ploda. Povećanje koncentracije kalcija u svježem mesu neoguljenog ploda, u odnosu na kontrolnu varijantu, kretalo se u rasponu od 29,8-37,3 % (3,0 t/ha Agrocala) do 92,6-137,8 % (9,0 t/ha Agrocala). Temeljem utvrđenog blaga prednost daje se proizvodu Agrocal (Ca+Mg) jer se radi o materijalu koji obogaćuje tlo kalcijem i magnezijem i rezultira povoljnijim odnosom kalcija i magnezija u plodu.

Ključne riječi: kiselost tla, kvaliteta ploda, mineralni sastav, vapneni materijali

The application of Holcim Agrocal products in calcization of apple orchard

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Abstract

The goal of this research was to determine the efficiency of Holcim Agrocal products, Agrocal (Ca+Mg) and Agrocal (Ca), for the neutralization of the harmful soil acidity and its efficiency on the yield and quality of the 'Idared' apple fruit. The field trial was set up in the time frame from 2013 to 2015, on a pseudogley soil in randomized block design with 7 treatments in 3 repetitions, at location Carevo selo, municipality Barilovic, Croatia. The average soil samples were taken 5 times in 0-30 cm and 30-60 cm depth (first soil sampling was carried out on 13 Dec 2013, before soil treatment; second soil sampling was in May, third in August, fourth in October 2014, and fifth in February 2015), while leaf samples were taken 3 times (in flowering, in phase of fruit size of 4-5 cm and in harvest) and fruit samples in harvest in 2014. The mineral content of fruit was analysed in unpeeled samples. A positive effect on soil pH was determined for both Holcim Agrocal products, among which Agrocal (Ca) resulted in higher pH values in contrast to Agrocal (Ca+Mg). With respect to the mineral content of leaves, both Agrocal products proved to have significant effect on the mineral content and fruit quality. The increase of the calcium concentration in the fresh unpeeled fruit, in contrast to the control treatment, is in a range from 29.8-37.8% (3 t/ha Agrocal) to 92.6-137.8% (9 t/ha Agrocal). Based on field experiments, Agrocal (Ca+Mg) is favourable product as it enriches the soil both with calcium and magnesium and results in desired ratio of calcium and magnesium in fruit.

Keywords: fruit quality, liming material, mineral content, soil acidity

Fenolni spojevi lista masline pri sušenju raspršivanjem

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Sažetak

Cilj ovog istraživanja bio je utvrditi utjecaj maltodekstrina, inulina, arapske gume i različitih kombinacija ovih spojeva (odnos 1:1), kao nosača u procesu sušenja raspršivanjem ekstrakta lista masline. Kako bi se utvrdila optimalna temperatura (120, 150, 180 °C) i optimalan omjer uzorka i nosača (3:1, 5:1) za svaki nosač, provedeno je sušenje raspršivanjem modelnih otopina galne kiseline te su u tu svrhu određeni prinos praha i učinkovitost zadržavanja fenola (spektrofotometrijsko određivanje pomoću Folin–Ciocalteu reagensa). Optimalna temperatura za sušenje uzoraka s gumom arabikom je 180 °C, dok je 150 °C optimalna temperatura za sušenje uz primjenu svih ostalih nosača. Optimalan omjer uzorka i nosača uzoraka s gumom arabikom te uzoraka s inulinom je 3:1, dok je za primjenu ostalih nosača optimalan omjer 5:1. Navedeni parametri zatim su korišteni za sušenje ekstrakta lista masline dobivenog ubrzanom ekstrakcijom otapalima uz povišeni tlak (PLE) te su provedene analize fizikalnih svojstava dobivenih prahova (vrijeme rehidratacije i nasipna gustoća). Upotrebom kombinacije maltodekstrina i arapske gume postignut je najveći prinos praha (56,5 %), najveća učinkovitost zadržavanja fenola (54,48 %) i dobra fizikalna svojstva praha. Međutim, najbolja fizikalna svojstva praha postignuta su upotrebom kombinacije inulina i arapske gume. Koncentracije ukupnih fenola u dobivenim prahovima povećane su više od tri puta u odnosu na prah lista masline prije ekstrakcije i sušenja.

Ključne riječi: sušenje raspršivanjem, list masline, polifenoli, inkapsulacija, modelne otopine

Phenolic content of olive leaf extract in spray drying process

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Abstract

The aim of this research is to evaluate the influence of maltodextrin, inulin, gum arabic and different mixtures of these components (ratio 1:1), as carrier in spray drying of olive leaf extract. To define optimal temperature (120, 150, 180 °C) and sample to solvent ratio (3:1, 5:1) for each carrier, there was carried out drying by spraying of gallic acid model solutions and total phenolic content (spectrophotometric method with Folin-Ciocalteu's reagent) of the encapsulated powders were determined for that purpose. Optimal temperature for samples with gum arabic was 180 °C, while for all other samples it was 150 °C. In addition, optimal sample to solvent ratio for samples with inulin, as well as gum arabic, was 3:1 while for all other samples it was 5:1. These obtained parameters were used for spray drying of the olive leaf extract obtained by pressurized liquid extraction (PLE) and conducted analyses of physical properties of the obtained powders (dissolution test, bulk density) were also performed. Mixture of maltodextrin and gum arabic resulted with the highest powder yield (56,5 %), the highest polyphenol retention (54,48 %) and good physical properties. However, the best physical properties were obtained in powder with mixture of inulin and gum arabic. Phenolic content in the obtained powders have increased more than three times compared to the olive leaf powder before extraction and drying.

Keywords: spray drying, olive leaf, phenolic content, encapsulation, model solutions

Usporedba kvalitete plodova jagode iz različitih sustava uzgoja

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Sažetak

Tijekom 2018. godine izvršena je analiza kvalitete svježe ubranih plodova jagode stalnorađajuće sorte 'Murano' i jednorodne sorte 'Joly' uzgojenih na tri različite lokacije u Zagrebačkoj županiji. Uspoređivana su dva sustava uzgoja (hidroponski u supstratu i uzgoj u tlu). Istraživani su fizikalni parametri ploda masa (g), tvrdoća (kg/cm^2) i boja ploda, a od kemijskih parametara topljiva suha tvar (^{o}Brix) i ukupne kiseline (g/L). Iako postavljena hipoteza daje prednost hidroponskom sustavu uzgoja, najbolje odnose parametara kvalitete ploda pokazali su plodovi stalnorađajuće sorte neutralnog dana 'Murano' iz sustava uzgoja u tlu. U obje berbe, sorta 'Murano' iz sustava uzgoja u tlu imala je najmanju masu ploda (19,48 g) i najtvrđe plodove (0,57 kg/cm^2) te je ovime dokazana negativna korelacija parametara mase i tvrdoće ploda jagode opisana ranije u literaturi. Isti plodovi su pokazali najviše vrijednosti omjera topljive suhe tvari i ukupnih kiselina (1,78) u drugoj berbi dok su u prvoj berbi jedino signifikantno niže vrijednosti spomenutog parametra zabilježene kod plodova sorte 'Murano' iz hidroponskog sustava uzgoja (0,93).

Ključne riječi: *Fragaria x ananassa* Duch., stalnorađajuće sorte, jednorodne sorte, hidroponski uzgoj

Comparison of strawberry fruit quality from different cultivation systems

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Abstract

During 2018 was examined fresh fruit quality of of day-neutral strawberry 'Murano' and short-day strawberry 'Joly' from three different locations in Zagreb County. Two types of cultivation systems were compared and those were hydroponics and conventional soil-based cultivation system. Examined physical parameters were weight (g), firmness (kg/cm^2) and colour of the fruit and chemical parameters were total soluble solids (^{o}Brix) and total titratable acidity (g/L). Although the set hypothesis puts a preference on the hydroponic cultivation system, the best correlation of fruit quality parameters was observed in fruits of day-neutral strawberry 'Murano' from soil-based cultivation system.

Fruit of day-neutral strawberry 'Murano' from soil-based cultivation system had the lowest weight value (19,48 g) and highest fruit firmness (0,57 kg/cm^2) which proves the negative correlation of these two parameters mentioned in the literature. Same fruits had the highest value of soluble solids and total acidity ratio (1,78) in the second harvest, while in the first harvest only fruits of the strawberry 'Murano' grown in the hydroponics system had significantly lower values (0,93) of the mentioned parameter.

Keywords: *Fragaria x ananassa* Duch., day-neutral strawberry, short-day strawberry, hydroponic system

Fauna člankonožaca (*Arthopoda*) u nasadu smokve (*Ficus carica* L.)

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Sažetak

Smokva (*Ficus carica* L.) je mediteranska voćna vrsta koja ima dugu tradiciju uzgoja na području Ravnih kotara. U fauni smokve zastupljene su neke štetne ali i brojne vrste korisnih člankonožaca. Osnovni cilj ovog rada bio je odrediti sveukupnu faunu člankonožaca smokve u zakorovljenom i pokošenom (malčiranom) nasadu. Istraživanje je provedeno u voćnjaku sa integriranim sustavom proizvodnje. Zastupljene sorte su: 'Zamorčica', 'Petrovača bijela' i 'Bjelica'. Uzorkovanje faune je obavljeno metodom otresanja grana, korištenjem žutih ljepljivih ploča, te lovnih posuda (pitfall trap). Otresanje je provedeno dva puta mjesečno, lovne posude su pregledavane tri puta mjesečno, a žute ploče jednom tjedno. Istraživanje je provedeno od početka svibnja do kraja kolovoza 2017. godine. Determinacijom je određen ukupan broj člankonožaca pojedinog reda, kao i udio štetne, korisne i neutralne faune. Tijekom ovog istraživanja sakupljeno je sveukupno 11 337 jedinki iz 10 redova, od toga 6 359 jedinki u zakorovljenom i 4 978 u pokošenom dijelu voćnjaka. Najbrojniji redovi bili su: Hemiptera (Homoptera) sa 64,65 % udjela u cjelokupnoj fauni, zatim Diptera (15,51 %), Hymenoptera (15,42 %) i Coleoptera (2,12 %). Udio štetne faune u zakorovljenom dijelu je iznosio 63,57 %, korisne 18,88 % i neutralne 17,97 %. Dok je u pokošenom dijelu udio štetne faune iznosio je 67,57 %, korisne 18,15 % i neutralne 17,97 %. Ovim istraživanjem nije uočena razlika u sastavu faune člankonožaca između zakorovljene i pokošene (malčirane) površine voćnjaka.

Ključne riječi: člankonošci, integrirani, pokošen, smokva, zakorovljen

Arthopod fauna in the fig tree (*Ficus carica* L.) orchard

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Abstract

The Common Fig (*Ficus carica* L.) is a Mediterranean fruit crop that has a long history of cultivation in the Ravni kotari area. In fig tree fauna there are some harmful but also many species of beneficial arthropods. The main aim of this research was to determine the overall arthropod fauna in weedy and mowed (mulched) fig orchard. The research was carried out in the orchard with an integrated system of production. Presented varieties were: 'Zamorčica', 'Petrovača bijela' i 'Bjelica'. The sampling was done by a mechanical knock-down method, using yellow sticky traps and pitfall traps. Mechanical knock-down sampling was performed twice a month, pitfall traps were examined three times a month, and yellow sticky traps once a week. This study was conducted from the beginning of May till the end of August 2017. The total number of individuals of each order was determined, as well as the proportion of harmful, beneficial and neutral fauna. During this research a total of 11 337 individuals belonging to 10 orders were collected, 6 359 individuals in weedy and 4 978 in mowed (mulched) orchard. The most abundant taxonomic groups were: Hemiptera (Homoptera) (64.65 %), Diptera (15.51 %), Hymenoptera (15.42 %) and Coleoptera (2.12 %). In a weedy orchard, 63.57 % belonged to harmful fauna, 18.15 % to useful fauna and neutral 17.97 %. Until in mowed part of orchard percentage of harmful fauna was 67.57 %, useful 18.15 % and neutral 17.97 %. In this research, there was no difference in the composition of the arthropod fauna between weedy and mowed (mulched) common fig orchard.

Key words: arthropods, common fig, integrated, mowed, weedy

Kemijsko prorjeđivanje šljive 'Topstar plus' u tri različita vremena cvatnje

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Sažetak

Period cvatnje šljiva traje od sedam do četrnaest dana, ovisno o vremenskim uvjetima. Cilj istraživanja bio je utvrditi u kojem vremenu cvatnje primjena amonij tiosulfata (ATS) ima najbolji učinak prorjeđivanja. Pokus je proveden na sorti 'Topstar plus' u proljeće 2018. godine u pokusnom voćnjaku Zavoda za voćarstvo i povrćarstvo u Donoj Zelini. Tretiranja su obavljena 13.4. u fenofazi BBCH 63 (30 % otvorenih cvjetova), 16.4. u BBCH 65 (50 % otvorenih cvjetova), te 18.4. u BBCH 67 (većina latica otpalo), u koncentraciji od 1,5 % ATS - a. Mjerena su svojstva: prirod po stablu, masa i veličina, topljiva suha tvar i tvrdoća ploda. Rezultati su statistički obrađeni analizom varijance i LSD testom.

Prirod po stablu kretao se od 33,9 kg/stablu (BBCH 63) do 53,4 kg/stablu (BBCH 65), i svi tretmani su se značajno razlikovali. Masa ploda iznosila je od 35,18 g (BBCH 67) do 49,04 g (BBCH 63). Značajno najmanja masa ploda utvrđena je za tretmane BBCH 67 i kontrolu, BBCH 65 imao je srednju (43,48 g), a BBCH 63 značajno najveću (49,04 g) masu ploda. Tvrdoća je iznosila od 510 g/cm2 (BBCH 67) do 886,67 g/cm2 (BBCH 65), a topljiva suha tvar od 14,17 °Brix - a (BBCH 63) do 15,93 °Brix – a (kontrola). Tretmani se u ovim svojstvima nisu značajno razlikovali.

Najbolji učinak prorjeđivanja bio je u fenofazi BBCH 65 (50 % otvorenih cvjetova - puna cvatnja), u fenofazi BBCH 63 (30 % otvorenih cvjetova) prorjeđivanje je bilo preveliko, dok je u fenofazi BBCH 67 (kraj cvatnje) učinak prorjeđivanja izostao.

Ključne riječi: šljiva, ATS, prorjeđivanje, prirod po stablu

Chemical thinning of 'Topstar plus' plum at three diferent time of flowering

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Abstract

Flowering time in plums lasts from 7 to 14 days, depending to the weather conditions. The aim of this study was to estimate best effect of application of ammonium thiosulfate depending to the time of flowering. Trail was conducted on variety 'Topstar plus' in the spring of 2018 in experimental orchard of the Institute of Pomology and Vegetable Growing in Donja Zelina. Treatments were performed in 13.4. at phenophase BBCH 63 (30 % flowers open), in 16.4. at BBCH 65 (50 % flowers open), and in 18.4. at BBCH 67 (majority of petals fallen). Concentration of ATS was 1,5 %. Following characteristics were measured: yield per tree, weight, size, firmness and soluble solids content of fruit. Data were statistically processed by variance analysis and LSD test. Yield per tree ranged from 33,9 kg/tree (BBCH 63) to 53,4 kg/tree (BBCH 65), all treatments were significantly different. Fruit weight ranged from 35,18 g (BBCH 67) to 49,04 g (BBCH 63). Fruit weight was significantly lowest at treatments BBCH 67 and control and significantly biggest at treatment BBCH 63. Fruit firmness ranged from 510 g/cm2 (BBCH 67) to 886,67 g/cm2 (BBCH 65), and soluble solids content from 14,17 °Brix (BBCH 63) to 15,93 °Brix (control). The treatments in these characteristics weren't significantly different.

Best thinning effect was at phenophase BBCH 65 (50 % flowers open), in phenophase BBCH 63 (30 % flowers open) thinning was excessively, while in the phenophase BBCH 67 (majority of petals fallen) thinning effect failed.

Key words: plum, ATS, thinning, yield per tree

Utjecaj tipa tresača na učinkovitost berbe maslina

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Sažetak

U uzgoju maslina berba je jedna od najvažnijih tehnoloških mjera u masliniku koja može utjecati na kvalitetu ulja. Masline se mogu brati ručno, uz pomoć različitih češljeva, raznim mehaničkim pomagalima te tresačima. Istraživanje je provedeno 2018. godine, u nasadu maslina zasađenih u super gustom sklopu (3,7 x 1,35 m) na pokušalištu Kaštel Štafilić Zavoda za voćarstvo i povrćarstvo HCPHS-a. Tijekom berbe korišteni su različiti tipovi tresači: pneumatski tresač s različitim izvedbama glave (valovitim - Mambo light i ravnim zubima - Mambo speed), te električni tresač (Falcon). Učinak rada tresača uspoređen je s ručnom berbom pomoću češljeva. Pokus je proveden na četiri sorte maslina: 'Cipressino', 'Tosca', 'Arbequina' i 'Koroneiki'. U provedenom istraživanju pračen je učinak berbe pojedinog tresača u jednoj minuti, prosječni utrošak vremena berbe po stablu za svaku pojedinu vrstu tresača, prosječnu količinu otresenog lišća, prosječni broj otpalih grančica (≥ 15 cm), te je izvršena procjena zaostalih plodova na stablu nakon berbe. Na svim sortama najučinkovitiji tresač pokazao se Mambo light koji je u jednoj minuti otresao najviše plodova ('Tosca' – 1613 g, 'Cipressino' - 1828 g, 'Arbequina' - 1311 g i 'Koroneiki' - 1115 g). Najmanja količina otresenog lišća utvrđena je kod ručne berbe maslina kod svih sorti osim kod sorte 'Koroneiki', gdje je prilikom upotrebe tresača Falcon otreseno najmanje lišća. Najmanji broj otrgnutih grančica utvrđen je kod Falcon tresača a najveći kod Mambo speed tresača za sve sorte u istraživanju.

Ključne riječi: maslina, tresač, učinkovitst berbe

Influence of a canopy shaker type on olive harvest efficiency

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Abstract

In olive production harvesting is one the most important technological measures that can affect olive oil quality. Olive harvesting can be done by hand, by different harvesting rakes, by different mechanical tools as well as by harvest shakers. Research were carried out during 2018. Season in olive corps planted in super dens growing system (3.7 x 1.35 m) planted in experimental orchard Kaštel Štafilić of the Institute of Pomology and Vegetable Crops of CCAFRA. During harvest were used different type of shakers: Pneumatic shaker with different head types (wavy - Mambo light and flat teeth - Mambo speed), as well as electrical shaker (Falcon). Work efficiency was compared to hand harvesting with harvesting rakes. Trial was implemented on four olive cultivars: 'Cipressino', 'Tosca', 'Arbequina' and 'Koroneiki'. Following parameters were measured in this trial – yield efficiency of individual shakers during one-minute, average time needed to harvest a tree for each cultivar, average amount of shaken down leaves, time used to harvest a tree for each type of a shaker, average amount of leaves that were shaken down, average number of fallen twigs (≥ 15 cm), as well as estimation of fruits that remained on a tree after harvesting. The most efficient harvester on all cultivars was Mambo light which has harvested most of the fruits in one minute (Tosca – 1613 g, Cipressino -1828 g, Arbequina - 1311 g and Koroneiki - 1115 g). The smallest amount of shaken down leaves was determined at hand harvesting for all cultivars except for cv 'Koroneiki' for which Falcon shaker has shaken down the least amount of leaves. The smallest amount of fallen twigs was determined for Falcon shaker and highest for Mambo speed shaker for all cultivar in this research.

Key words: olive, harvest shaker, harvest efficiency

Gljive povezane sa sušenjem šipka (*Punica granatum* L.) u Dalmaciji

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Sažetak

Šipak je visoko vrijedna voćna vrsta koja se u priobalju Hrvatske tradicionalno uzgaja kao grm ili ukrasno stablo u vrtovima i okućnicama, a ima i veliki neiskorišteni potencijal plantažnog uzgoja. Podložna je napadu brojnih fitopatogenih gljiva koje uzrokuju različite bolesti od kojih se najvažnijima smatraju bolesti ploda, a u novije vrijeme i bolesti drva šipka. Simptomi bolesti drva šipka uključuju pucanje kore, nekrozu drva, rak rane, kloroze lišća, sušenje izboja, grana te čitavih stabala, a kao mogući uzročnici navode se gljive iz rodova *Ceratocystis, Coniella* i *Cytospora*. Tijekom 2017. godine, navedeni simptomi uočeni su na više lokaliteta na području Dalmacije, stoga je cilj istraživanja bio utvrditi poveznicu navedenih simptoma s fitopatogenim gljivama. Sakupljeni su uzorci drva simptomatskih biljaka različitih sorti, iz kojih su izolirane gljive. Izolati gljiva identificirani su na temelju fenotipskih obilježja na hranjivoj podlozi PDA, a dio izolata dodatno je identificiran analizom molekularnih markera ITS i EF1-α. U svim analiziranim uzorcima drva utvrđena je prisutnost gljive *Cytospora punicae,* poznatog uzročnika raka i sušenja šipka u svijetu, a *Penicillium* sp. i *Alternaria* sp. bile su prisutne u tek manjem broju uzoraka. Zaključeno je da je *C. punicae* vjerojatni uzročnik sušenja šipka u Dalmaciji što će biti potrebno dodatno provjeriti testovima patogenosti. Ovo je prvi nalaz *C. punicae* na šipku u Hrvatskoj.

Ključne riječi: šipak, *Punica granatum*, *Cytospora punicae*, sušenje

Fungi associated with dieback of pomegranate (*Punica granatum* L.) in Dalmatia

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Abstract

Pomegranate is a fruit species of high value which is traditionally grown as a fruit or ornamental tree in gardens in the Croatian coastal area and has a large unused potential for commercial cultivation. It is susceptible to a number of phytopathogenic fungi that cause various diseases, with fruit, and more recently wood diseases, being considered as most important. Symptoms of pomegranate wood diseases include scarring of bark, wood necrosis, cankers, chlorotic leaves, dieback of shoots, branches and whole trees, while fungi from genera *Ceratocystis*, *Coniella* and *Cytospora* are reported as possible causal agents. During 2017, these symptoms were observed on several sites in Dalmatia, so the aim of this study was to determine a link between observed symptoms and phytopathogenic fungi. Wood samples from symptomatic plants of different varieties were collected from which fungi were isolated on PDA media and tentatively identified on the basis of morphology. Part of the isolates were further identified based on analysis of molecular markers ITS and EF1-α. In all analyzed samples, the presence of fungus *Cytospora punicae*, a known cause of dieback of pomegranate, was determined, while *Penicillium* sp. and *Alternaria* sp. were present in small number of samples. It is concluded that *C. punicae* is a probable cause of pomegranate dieback in Dalmatia, which will have to be further tested by pathogenicity trials. This is the first report of *C. punicae* on pomegranate in Croatia.

Key words: pomegranate, *Punica granatum*, *Cytospora punicae*, dieback

Jačanje prognoze pojave maslinine muhe uspostavljanjem mreže agro-meteorloloških postaja u Zadarskoj županiji

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Sažetak

Maslina (*Olea europea L.*) je gospodarski značajna kultura mediteranskog podneblja. Maslinina muha (*Bactrocera* (*Daculus*) *oleae* (Gmelin, 1790)) s obzirom na vremenske prilike uzrokuje gospodarske štete na pojedinim lokalitetima. Štete je moguće predvidjeti pravovremenom prognozom leta odraslih oblika postavljanjem feromonskih klopki i žutih ljepljivih ploča. Pojavnost šteta je usko vezana uz temperature i količinu te raspored oborina na pojedinim lokacijama. Zadarska županija je u sklopu projekta PESCAR (Interreg-IPA-CBC (HR-BA-ME277) na deset lokaliteta postavila mrežu agrometeoroloških postaja u svrhu razvoja infrastrukture da maslinari uspješnije suzbijaju štetnike i smanjuju upotrebu pesticida. Cilj rada je usporediti datume pojavnosti i dinamiku leta s podacima o srednjoj dnevnoj temperaturi i količini oborina na pojedinim lokalitetima. Svrha rada je razvijati model učinkovitije prognoze i doprinjeti integriranoj proizvodnji maslina preporučujući tretiranja insekticidima temeljem agrometeorloških podataka. Redovitim praćenjem leta muhe i agrometeoroloških podataka uočeno je da pojavnost i dinamika populacije maslinine muhe nije jednaka na cijelom području Zadarske županije. Usporedbom agrometeoroloških podataka s dinamikom populacije na pojedinim lokalitetima započeta je razrada modela koji predviđa datum pojavnosti i rast populacije maslinine muhe. Preliminarni rezultati su raspravljeni s literaturom, a uspješnost modela će rasti s višegodišnjim mjerenjima i usporedbama pojavnosti, leta i agrometeoroloških podataka.

Ključne riječi: agrometeorloške postaje, *Bactrocera oleae*, dinamika populacije, *Olea europea*, Zadarska županija.

Strengthening the forecast of olive fly by establishing a network of agro-meteorological stations in Zadar County

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Abstract

Olive (*Olea europea L.*) is an economically significant Mediterranean culture. Olive fly (*Bactrocera* (*Daculus*) *oleae* (Gmelin, 1790)) with regard to weather conditions cause economic damage on certain localities. Damage can be predicted by weather forecasting of adult flight, than by placing pheromone and yellow sticky traps. The appearence of damage is closely related to the amount and distribution of precipitation at certain locations. The Zadar County within the PESCAR project (Interreg-IPA-CBC (HR-BA-ME277)) has set up on 10 sites a network of agro-meteorological stations for the purpose of infrastructure development to protect the olives from pests and reduce the use of pesticides. The aim of this paper is to compare the dates of occurrence and flight and olive fly population dynamics data on average daily temperature and rainfall in some localities. The purpose of this paper is to develop a model for more efficient prognosis and to contribute to integrated olive production, recommending the treatment of insecticides based on agrometeorological data. Regular monitoring of flight and agrometeorological data it has been recognized that occurrence and dynamic of olive fly population is different on the area of the Zadar Country.By comparing agrometeorological data with the dynamics of the population in some localities, a model has been elaborated which foresees the date of appearance and the growth of the olive fly population. With multi-year measurements and comparisons of occurrence, flight and agrometeorological data, precision of model will raise.

Key words: agro-meteorological stations, *Bactrocera oleae*, population dynamics, *Olea europea*, Zadar County.

Utjecaj kalcija na morfometrijske i histološke promjene plodova trešnje 'Regina' i 'Sweetheart'

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Sažetak

U suvremenom uzgoju trešnje jedan od vodećih problema je pucanja plodova u vrijeme dozrijevanja. Na pucanje plodova utječu brojni čimbenici kao što su genom kultivara, količina i raspored oborina te vlaga u tlu. Folijarna primjena količine kalcija može smanjiti postotak pucanja, ali različito utjecati na plodove trešnje. Cilj istraživanja bio je utvrditi utjecaj broja tretiranja kalcijem (tretman 1 – T1 tretiranje dva puta 2%-tnom otopinom kalcija; tretman 2 – T2 tretiranje šest puta 2%-tnom otopinom kalcija i kontrola – K bez tretiranja kalcijem) na morfometrijske i histološke promjene plodova trešnje 'Regina' i 'Sweetheart'. Kod kultivara 'Regina' nije utvrđena značajna razlika u masi i dimenzijama ploda između plodova kontrole i T1, dok je T2 utjecao na povećanje mase i dimenzija ploda kod oba istraživana kultivara. T1 je kod kultivara 'Regina' utjecao na povećanje duljine peteljke i duljine stanice egzokarpa, a kod kultivara 'Sweetheart' na povećanje debljine kutikule i širine stanice egzokarpa. Kod oba istraživana kultivara pod utjecajem T1 utvrđeno je povećanje debljine stanične stjenke i površine stanice egzokarpa u odnosu na kontrolu, dok je pod utjecajem T2 utvrđena najmanja debljina kutikule ploda, debljina stanične stjenke te duljina i površina stanice egzokarpa. Rezultati ukazuju da je T2 pozitivno djelovao na morfometrijske ali ne i na histološke promjene, dok se manji broj tretiranja (T1) pokazao učinkovitijim, što znači da učinkovitost tretiranja kalcijem značajno ovisi i o broju tretiranja.

Ključne riječi: kalcij, morfometrijske i histološke promjene, plod, trešnja

Effect of calcium on morphometric and histological changes of sweet cherry fruit 'Regina' and 'Sweetheart'

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Abstract

Fruit cracking is one of the main problems in modern sweet cherry cultivation. Fruit cracking is influenced by numerous factors such as cultivar genome, amount and distribution of precipitation and soil moisture. Foliar calcium application can reduce fruit cracking, but also can have a different effect on sweet cherry fruits. Aim of the research was to determine effects of the number of calcium treatments (treatment 1 – T1 two 2% calcium solution spraying; treatment 2 – T2 six 2% calcium solution spraying; control – K without calcium solution spraying) on morphometrical and histological changes in a sweet cherry fruits 'Regina' and 'Sweetheart'. In cultivar ' Regina' hasn't been determined significant difference in fuirt mass and dimensions between control and T1, while T2 had increased fruit mass and dimensions on both cultivars. On cultivar 'Regina' T1 had affected the increase of the lenght of the penducle and exocarp cell lenght and on cultivar 'Sweetheart' cuticle thickness and exocarp cell width was increased. On both cultivars T1 had effect on increase of cell wall thickness and exocarp cell surface compared to the control, while under the effect of T2 was determined lowest thickness of fruit cuticle, cell wall thickness and exocarp cell surface. The results indicate that T2 had a positive effect on morphometric, but not on a histological changes, while a smaller number of treatments (T1) proved to be more effective, meaning that the efficiency of calcium treatment also depends significantly on the number of treatments.

Keywords: calcium, morphometric and histological changes, fruit, sweet cherry

Utjecaj podloge 'Oblice' na vegetativni rast precijepljenih sorti maslina u Zadarskoj županiji

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Sažetak

Cijepljenje je dugo poznati način vegetativnoga razmnožavanja koji se prvenstveno koristi u proizvodnji voćnog sadnog materijala, dok je precjepljivanje maslina (*Olea europaea L.*) pomotehnički zahvat kojim se na već razvijenim stablima maslina cijepi nova sorta. Jedan dio maslinka u Zadarskoj županiji podignut je na područjima gdje se javljaju nepovoljni agroekološki uvjeti za uzgoja sorte 'Oblica'. Precjepljivanjem se uvode sorte koje su prikladnije za te uvjete uzgoja. Cilj ovog rad je kroz mjerenje parametara vegetativnog rasta (duljina i broja izbojaka i broja listova) istražiti kako se vegetativno razvijaju cijepljene sorte maslina na podlozi 'Oblice'. Cijepljeno je sedam domaćih sorti maslina: 'Buža', 'Drobnica', 'Istarska Bjelica', 'Krvavica' 'Lastovka', 'Levantinka' 'Masnača' i dvije introducirane sorte 'Pendolino' i 'Picholine'. Rezultati jednogodišnjeg istraživanja pokazali su da je najveću srednju vrijednost broja izbojaka imala sorta 'Lastovka'. Prema srednjoj vrijednosti duljine izbojaka te srednje vrijednosti broja listova najveći prirast imala je sorta 'Pendolino'. Najmanju srednju vrijednost za broj i duljinu izbojaka kao i broj listova imala je sorta 'Krvavica'. Zaključak je izveden na temelju istraživanja gdje se sve sorte vegetativno ne razvijaju jednako nakon precjepljivanja te da su potrebna daljina istraživanja u različitim agroekološkim uvjetima. Potrebno je i detaljnije opisati razvoj precijepljenih sorti maslina na već razvijenim stablima sorte 'Oblice'.

Ključne riječi: cijepljenje, podloge, sorte masline, vegetativni prirast, Zadarska županija

The effect of 'Oblica' rootstock on the vegetative growth of grafted olive cultivars (*Olea europaea* L.) in the Zadar County

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Abstract

Grafting is an vegetative propagation technique that has been used for the production of fruit propagating material, while olive tree (*Olea europaea L.*) grafting is a pomotechnical measure involving grafting of the new cultivar onto the mature stock. Some olive tree groves in the Zadar county are located in the areas exposed to adverse agro-ecological conditions for the growth of the 'Oblica'. Grafting has been used to develop cultivars that would be better fitted for this type of conditions. The aim of the field study was to monitor the vegetative growth parametres (the length and the number of shoots and the number of flowers) and research development of vegetative growth on grafted olives with 'Oblica' rootstock. Seven local olive tree varieties were grafted: 'Buža', 'Drobnica', 'Istarska Bjelica', 'Krvavica', 'Lastovka', 'Levantinka', and 'Masnača', alongside two introduced varieties: 'Pendolino' and 'Picholine'. The field study carried out over the period of one year showed the highest mean value for shoots in the 'Lastovka' cultivar. The highest growth measured by the mean value of shoot length and the number of leaves was demonstrated by the 'Pendolino' cultivar. The lowest mean values for the number of shoots and the length of leaves were measured in the 'Krvavica' cultivar. This experiment demonstrates that not all varieties react equally well to grafting and that further studies involving various agro-ecological environments. It is required to collect detailed information on the growth of olive cultivars grafted on mature 'Oblica' rootstock.

Key words: grafting, olive cultivars, rootstock, vegetative growth, Zadar County

In vitro mikropropagacija sibirske borovnice kultivara 'Kalinka', 'Balalaika' i 'Polar Jewel'

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Sažetak

Obzirom na njenu visoku nutritivnu i farmaceutsku vrijednost sibirska borovnica (*Lonicera caerulea L. var. kamtschatica*) je jedna od najatraktivnijih jagodastih voćnih vrsta. Borovnice se tradicionalno razmnožavaju reznicima što je vrlo sporo te zahtjeva intenzivan ljudski rad. Alternativan sustav razmnožavanja u odnosu na tradicionalno razmnožavanje reznicima može biti mikropropagacija. Cilj istraživanja bio je razviti protokol za uspješnu mikropropagaciju kultivara sibirske borovnice: 'Balalaika', 'Kalinka' i 'Polar Jewel'. Istraživanje je provedeno u laboratoriju za kulturu biljnoga tkiva na Poljoprivrednom institutu Osijek, tijekom 2017. godine. Istraživan je utjecaj medija MS (Murashige and Skoog) i DKW (Driver and Kuniyuki Walnut) s različitim vrstama i koncentracijama biljnih hormona na multiplikaciju i in vitro ukorjenjivanje. Najviša stopa multiplikacije je postignuta na DKW mediju sa 4 mg/l 6-benzilaminopurina (BAP) i 1 mg/l indol 3-maslačne kiseline (IBA) kod kultivara 'Balalaika' i 'Polar Jewel', dok je kod kultivara 'Kalinka' najviša multiplikacija postignuta na DKW mediju sa 2 mg/l 6-benzilaminopurina (BAP) i 0,5 mg/l indol 3-maslačne kiseline (IBA). Najbolje ukorjenjivanje mikro izdanaka postignuto je na DKW mediju sa 1 mg/l indol 3-maslačne kiseline (IBA). Rezultati dobiveni u ovom istraživanju mogu se iskoristiti za brzo razmnožavanje odabranih kultivara, za komercijalnu proizvodnju sibirske borovnice.

Ključne riječi: borovnica, in vitro, mikrorazmnožavanje, multiplikacija, ukorjenjivanje

Micropropagation in vitro of Siberian blueberry cultivars 'Kalinka', 'Balalaika' i 'Polar Jewel'

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Abstract

Considering her high nutritional and pharmaceutical value Siberian blueberry (*Lonicera caerulea L. var. kamtschatica*) is one of the most attractive types of berry fruit. Blueberries are traditionally propagated by stem cuttings which is slow and labor intensive method. Alternative propagation system to the classical, traditional method of propagation by cuttings, could be a micropropagation. The aim of this study was to develop an efficient protocol for micropropagation of Lonicera kamtchatica: 'Balalaika', 'Kalinka' i 'Polar Jewel'. The experiment was conducted at plant tissue culture laboratory, Agricultural institute Osijek, during 2017. We investigated the effects of two basal nutrient media, MS (Murashige and Skoog) and DKW (Driver and Kuniyuki Walnut) with different type and concentration of plant hormones, on shoot multiplication and in vitro rooting. The highest multiplication rate was obtained on DKW medium supplemented with 4 mg/l 6-benzylaminopurine (BA) and 1 mg/l indole-3-butyric acid (IBA) for cultivars 'Balalaika' and 'Polar Jewel', while of cultivar 'Kalinka' with DKW medium and 2 mg/l 6-benzylaminopurine (BA) and 0,5 ml/l indole-3- butyric acid (IBA).The best microshoot rooting rates were achieved on DKW basal nutrient medium with 1 mg /l indol-3- butyric acid (IBA). The results obtained in this study could be used for rapid propagation of selected cultivars, for commercial blueberry production.

Key words: blueberry, in vitro, micropropagation, multiplication, rooting

Različitost morfoloških svojstava ploda primki jabuke u *ex situ* kolekciji banke biljnih gena Donja Zelina

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Sažetak

U periodu od 2015. – 2018. godine u sklopu Nacionalnog programa očuvanja i održive uporabe biljnih genetskih izvora za hranu i poljoprivredu u Republici Hrvatskoj, prikupljeno je i posađeno 89 primki jabuke (*Malus domestica* Borkh.) u *ex-situ* kolekciji kontinentalnih voćnih vrsta na pokušalištu Donja Zelina Hrvatskog centra za poljoprivredu, hranu i selo. Za primke koje su nakon ulaska u rod dale dovoljno plodova za mjerenja započeta su morfološka i pomološka mjerenja i opažanja sukladno tehničkim protokolima za provođenje DUS ispitivanja jabuke CPVO/TP-014/2 (2006) Ureda EU za zaštitu novih biljnih sorti (Community Plant Variety Office - CPVO) te *Malus* deskriptorima (Pomefruit C&E projekt, 2017/2018) Europskog zajedničkog programa za biljne genetske izvore (European Cooperative for Genetic Resources - ECPGR). Tijekom 2018. vegetacijske godine obavljena su morfološka opažanja i mjerenja ploda na 50 primki jabuke iz *ex situ* kolekcije. Plodovi su opisani pomoću 32 kvantitativna i 6 pseudokvantitativnih svojstava, te s četiri senzorna deskriptora. Primke su pokazale značajnu varijabilnost te visok stupanj morfološke raznolikosti za većinu promatranih svojstava. Najveće razlike su utvrđene za svojstva veličine, visine i promjera ploda, te svojstva vezana za obojenost ploda (relativna površina pod dopunskom bojom, nijansa te intenzitet dopunske boje) kao i za svojstvo tvrdoće ploda. Najmanje razlike su utvrđene za svojstva boje mesa ploda te širinu i dubinu okca.

Ključne riječi: biljni genetski izvori, primka, jabuka, deskriptori, DUS ispitivanje

Difference in morphological fruit characteristics of apple accessions from *ex situ* gene bank collection in Donja Zelina

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Abstract

In a period from 2015 – 2018 within the National Programme for Conservation and Sustainable Use of Plant Genetic Resources for Food and Agriculture in the Republic of Croatia, in total of 89 apple (*Malus domestica* Borkh.) accessions was collected and planted in *ex situ* collection of continental fruit crops in Experimental orchard Donja Zelina of the Croatian Centre for Agriculture, Food and Rural Affairs. Accessions that have yielded enough fruits needed to perform necessary descriptions, morphological and pomological measurements and observations according to technical protocols for DUS testing of apple CPVO/TP-014/2 (2006) of the Community Plant Variety Office (CPVO) as well as Malus descriptors (Pomefruit C&E project, 2017/2018) of the European Cooperative Programme for Plant Genetic Resources (ECPGR) started. During 2018 vegetation year fruit morphological observations and measurements were performed on 50 apple accessions from ex situ collection. Fruits were described using 32 quantitative and 6 pseudo-quantitative characteristics as well as four sensory descriptors. Accessions have displayed significant variability and high percentage of morphological diversity for majority of measured characteristics. The highest differences were determined for following DUS characteristics - fruit size, fruit height and fruit circumference and for characteristics related to fruit skin colouring (relative area, hue and intensity of over colour) as well as for fruit firmness characteristic. Minimal differences were determined for following characteristics fruit flesh colour as well as for width and depth of fruit eye basin.

Key words: plant genetic resources, accession, apple, DUS testing, descriptors

Effect of olive leaf addition during extraction on FAEE and waxes of cv. 'Buža' olive oil

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Abstract

The aim of this study was to investigate the effect of leaf addition during the extraction on the fatty acid ethyl esters (FAEE) and wax composition of olive oil. 'Buža' cultivar from olive were harvested and the fresh leaves of the same cultivar were added at different rates (0% - control and 2.5%) prior to oil extraction. Oil samples were processed using a laboratory scale olive mill and the experiment was done in triplicates. FAEE and waxes were determined according to the method described in EEC regulation (Commission Regulation (EEC) No 2569/91) using a gas chromatograph with a flame ionization detector. The results obtained from this study suggested that the addition of olive leaf during olive oil extraction induces a slight increase in C16 and C18 ethyl esters, and therefore in the FAEE parameter, but oils still fulfilled the demands of the current EU legislation required for extra virgin olive oil. Leaf addition had a slight influence on the content of individual waxes (C40 and C46) but had no influence on the total waxes. The addition of leaves at the rate of 2.5% during oil extraction did not compromised 'Buža' olive oil quality with respect to the FAEE parameter, nor its authenticity with respect to the waxes content.

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Key words: Olive oil, Olive leaf addition, Extraction process, FAEE, Waxes

Utjecaj reflektirajuće folije na fizikalno-kemijska svojstva plodova jabuke

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Sažetak

Fizikalno-kemijska svojstva značajan su čimbenik u procjeni kvalitete i tržišne vrijednosti plodova jabuke. U intenzivnoj proizvodnji jabuke teži se primjeni novijih tehnologija u cilju poboljšanja kvalitete ploda. Cilj rada bio je utvrditi utjecaj reflektirajuće folije Lumilys™ na fizikalno - kemijska svojstva plodova jabuka 'Wilton's ®Red Jonaprince' i 'Jonagold Novajo®'. Reflektirajuća folija postavljena je u nasadu između redova istraživanih sorata četiri do šest tjedana prije berbe, a kontrolu su činili redovi bez folije. Plodovi su ubrani u optimalnom roku berbe i potom su izvršene analize boje, mase i dimenzija plodova, tvrdoća, indeks razgradnje škroba, udio topljive suhe tvari i ukupnih kiselina. Analizom kromatskih vrijednosti utvrđeno je da su plodovi sa stabala gdje je unutar redova bila postavljena reflektirajuća folija imali veći intenzitet crvene boje, a manji intenzitet zelene boje prema CIE L*a*b sustavu boja. Reflektirajuća folija je pozitivno utjecala na masu i dimenzije ploda kod obje istraživane sorte, dok su značajno veća tvrdoća, udio topljive suhe tvari i najmanji indeks razgradnje škroba utvrđeni kod plodova 'Wilton's ®Red Jonaprince'. Plodovi sorte 'Jonagold Novajo® imali su značajno manju tvrdoću u odnosu na kontrolu. Nije utvrđena značajna razlika u udjelu ukupnih kiselina između istraživanih sorata. Reflektirajuća folija Lumilys™ pokazala je pozitivan utjecaj na fizikalno-kemijska svojstva plodova istraživanih sorata što upućuje na njen potencijal u postizanju standarda kvalitete plodova jabuka.

Ključne riječi: fizikalno-kemijska svojstva, jabuka, plod, reflektirajuća folija

Influence of reflective groundcover on apple fruits quality

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Abstract

Physico-chemical characteristics are a significant factor in assessing the quality and market value of apple fruit. In intensive apple production, new technologies are being applied to improve the fruit quality. The aim of this work was to determine influence of the reflective groundcover Lumilys™ on physico-chemical characteristics of apple fruits cv. 'Wilton's ®Red Jonaprince' i 'Jonagold Novajo®'. Reflective groundcover was placed in the plantation between the rows of the examined cultivars, four to six weeks before harvest, and the control was made of non - groundcover rows. The fruits were harvested in the optimal harvesting time and then analyzed by color, mass and size of fruits, firmness, starch degradation index, the soluble solids content and total acids. By analysis of chromatic values it was found that the products of trees where reflective groundcover was placed within rows had a higher intensity of red color and lower intensity of green color by the CIE L*a*b color system. Reflective groundcover has had positive effect on the mass and size of the fruit in both examined cultivars, while significantly higher firmness, the proportion of soluble solids content and lowest starch degradation index were found in the fruits 'Wilton's ®Red Jonaprince'. The fruits of the 'Jonagold Novajo®' cultivar had a significantly lower firmness in regards to control. There was no significant difference in the part of total acids between the examined cultivars. Reflective groundcover Lumilys™ has showed positive effect on physico - chemical characteristics of the fruits of the tested cultivars, which indicates it's potential in achieving apple fruits quality standards.

Key words: apple, fruit, physico - chemical characteristics, reflective groundcover

Mineralni sastav lista višnje 'Maraske' u dvije klimatski različite godine

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Sažetak

Višnja 'Maraska' (*Prunus cerasus* var. *marasca*) u Dalmaciji se uzgaja više od pet stoljeća. Antioksidacijska, antimikrobna, antikancerogena i ina svojstva višnje 'Maraske' svrstavaju je u kategoriju „funkcionalne hrane“, koja ima terapeutski utjecaj na ljudsko zdravlje. Obzirom da je harmonična ishranjenost osnovni preduvjet za veće iskorištenje biološkog potencijala višnje 'Maraske' kao i za osiguranje kvalitete ploda, provedena istraživanja imala su za cilj utvrditi mineralni sastav lista u dvije klimatski različite godine (2012 i 2013). Ukupna količina oborina u 2012. godini bila je značajno niža od količine oborina utvrđenih u 2013. godini, dok razlike u srednjim mjesečnim temperaturama nisu bile velike. Opskrbljenost lista višnje 'Maraske' makro i mikroelementima značajno se razlikovala ovisno o godini istraživanja, fizikalno-kemijskim svojstvima tla i ekspoziciji voćnjaka. Za razliku od dušika i kalcija (optimalna opskrbljenost), opskrbljenost lista kalijem bila je značajno niža 2012. godine. Ovo se može dovesti u vezu s nepovoljnim klimatskim prilikama u vegetacijskom razdoblju i jakom fiksacijskom sposobnosti crvenica. U tim uvjetima u značajnoj mjeri narušen je odnos K:Ca i Ca:Mg, jer uslijed visokih temperatura i nedostatka vlage dolazi do ubrzanog procesa starenja, odnosno prisilne zriobe. Temeljem utvrđenog može se zaključiti da je održavanje optimalne vlažnosti tla uz odgovarajuću relativnu vlažnost zraka ključni faktor za uspješnu proizvodnju višnje 'Maraske'.

Ključne riječi: klimatske prilike, mineralni sastav lišća, višnja 'Maraska'

Mineral composition of sour cherry cv. 'Maraska' leaf in the climatic two different years

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Abstract

Sour cherry 'Maraska' (*Prunus cerasus* var. *marasca*) in Dalmatia has been grown for more than five centuries. Antioxidant, antimicrobial, anticancerogenic and other properties are classified 'Maraska' as "functional food", which have a therapeutic influence on human health. Considering that harmonic nutrition is a basic precondition for greater utilization of biological potential of 'Maraska' cherry as well as to ensure quality of the fruit, conducted research was aimed to determine the mineral composition of 'Maraska' leaf in the two climatic different years (2012 and 2013). The total amount of precipitation in 2012 was significantly lower compared to those in 2013, while the differences in average monthly temperatures values were not notably. Determined leaves macro and microelements content were significantly different depending on the year of research, the physico-chemical properties of the soil and the exposure of the orchard. Unlike nitrogen and calcium (optimal supply), leaf potassium supply was significantly lower in 2012. That can be attributed to the unfavorable climatic conditions during the growing season and a strong fixation ability of soil. Due to high temperatures and lack of moisture, the K:Ca and Ca:Mg ratio was disrupted and rapidly aging process or forced maturation occured under such conditions. Based on the established, it can be concluded that maintaining of optimum soil humidity with adequate relative air humidity is a key factor for successful production of 'Maraska' sour cherry.

Key words: climatic conditions, mineral composition of leaves, sour cherry 'Marasca'

Procjena i opis svojstava genotipova lijeske in situ u okviru programa banke biljnih gena

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Sažetak

U sklopu Nacionalnog programa očuvanja i održive uporabe biljnih genetskih izvora za hranu i poljoprivredu u RH uključene su i primke lijeska (*Corylus spp.*) koje su zasađene u *ex situ* kolekciji pokusnog voćnjaka HCPHS u Donjoj Zelini. U kolekciji se nalaze i primke autohtonih genotipova lijeske 'Istarski duguljasti' i 'Istarski okruglasti' koje vode porijeklo iz Istre i predstavljaju značajan izvor genetske varijabilnosti unutar populacije lijeske. Zbog velikog doprinosa i značaja očuvanja vrijednih genetskih resursa potrebno je determinirati i sačuvati naše autohtone genotipove lijeske. Obilaskom terena locirana su stabla kandidati in situ te su provedena opažanja, mjerenja i analize za potrebe opisa primki. Tijekom istraživanja utvrđena je morfološka raznolikost unutar populacije lijeske. U analizi autentičnosti korištena su svojstva navedena u vodiču UPOV-a TG/71/3 za provođenje testova različitosti, ujednačenosti i postojanosti (DUS ispitivanje) za lijesku, s naglaskom na morfološka i pomološka svojstva. Da bi se utvrdile razlike na temelju morfometrijskih svojstava, izvršena je analiza prikupljenog biljnog materijala novim sofisticiranim tehnologijama pomoću WinFOLIATM i WinSEEDLETM sustava. Analiza pomoću ovih tehnologija pokazuje veću pouzdanost i predstavlja značajan napredak za točniju karakterizaciju primki voćnih vrsta. Utvrđena je značajna varijabilnost između primki te visok stupanj morfološke raznolikosti za većinu istraživanih svojstava. Nastavno na utvrđenu varijabilnost među primkama in situ, dobiveni rezultati upućuju na potrebu kolekcioniranja primki kako bi se potvrdila varijabilnost u istovjetnim uvjetima.

Ključne riječi: biljni genetski izvori, primka, lijeska, deskriptori

Evaluation and description of hazel gentopye characteristics in situ within the Plant Genetic Resources Programme

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Abstract

Within the National Programme for Conservation and Sustainable Use of Plant Genetic Resources for Food and Agriculture in the Republic of Croatia, hazel (*Corylus spp.*) accessions are included in *ex situ* collection of the CCAFRA Experimental orchard in Donja Zelina. Collection includes accessions of indigenous hazel cultivars 'Istarski duguljasti' and 'Istarski okruglasti' originating from Istria and represent significant sources of genetic variability within the hazel population. Due to their contribution to and significance in preservation of valuable genetic resources there is a need to identify and retain our indigenous hazel genotypes. In situ candidate trees were located during field excursions and necessary observations, measurements and analysis were performed in order to describe accessions. Morphological diversity within hazel population was determined during the research. In authenticity analysis characteristics from UPOV guideline TG/71/3 for the conduct of tests for distinctness, uniformity and stability (DUS test) for hazel with emphasis on morphological and pomological characteristics. In order to determine differences based on morphometric characteristics, analysis of collected plant material was conducted by using new sophisticated technologies WinFOLIATM and WinSEEDLETM software. Analysis done by these technologies displays higher reliability and represents significant progress in accurate characterization of fruit crop accessions. Significant variability between accession and high degree of morphological diversity for majority of researched characteristics was determined. Following the determined variability between accessions in situ, obtained results emphasize the need to collect accessions in order to confirm the variability in identical conditions.

Key words: plant genetic resources, accession, hazel, descriptors

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Zbornik sažetaka

Poljoprivredna tehnika

Primjena laboratorijskih i terenskih metoda u procjeni hidrauličkih parametara i transportnih procesa u tlu

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Sažetak

Praćenje transporta tvari u tlu (npr. pesticida, nutrijenata) je važna komponenta u istraživanjima onečišćenja (agro)ekosustava. Agrokemikalije primijenjene u poljoprivrednoj proizvodnji mogu se procijediti do vodnih resursa kao posljedica neadekvatne primjene ili uslijed djelovanja okolišnih uvjeta (propusniji tipovi tala, oborine velikog intenziteta). U svrhu praćenja transportnih procesa u tlu primjenjuju se različite laboratorijske i terenske metode. Za procjenu toka vode i transporta tvari u tlu nužno je poznavanje hidrauličkih parametara tla. Evaporacijska metoda omogućuje određivanje retencijskih krivulja tla na neporušenim uzorcima tla (volumena 250 cm3) uz pomoć tenziometara i gravimetrijskog određivanja količine vode. Korištenjem kolona s tlom (neporušeno stanje) također je moguće u kontroliranim uvjetima pratiti transport i ispiranje tvari. Navedena metoda omogućuje primjenu više vrsta senzora, kontrolu intenziteta oborina i mogućnost aplikacije različitih doza istraživane tvari. Najefikasnija terenska metoda praćenja transportnih procesa u tlu je korištenje lizimetara, koji omogućuju praćenje transporta tvari u stvarnim agroekološkim uvjetima uz mogućnost kontinuiranog motrenja vodne bilance, evapotranspiracije i kakvoće procjednih voda. Predstavljene metode omogućuju kvalitetnu podlogu za procjenu opasnosti od onečišćenja vodnih resursa agrokemikalijama te za primjenu predikcijskih numeričkih modela u istraživanjima njihova transporta u agroekosustavu.

Ključne riječi: monitoring, vodni resursi, metodologija praćenja pronosa tvari, hidraulika

Use of different laboratory and field methods for estimation of soil hydraulical and transport processes

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Abstract

Monitoring of solute transport in soil (e.g. pesticides, nutrients) is an important aspect in research of (agro)ecosystem pollution. Agrochemicals used in agricultural production can leach to underground and surface waters, usually if inadequately used or because of the influence of certain environmental conditions (e.g. soils with light texture, high intensity precipitation). Different laboratory and field methods are used in monitoring of solute transport processes in soil. For the estimation of soil water flow and solute transport processes, it is an imperative to assess soil hydraulic parameters. Evaporation method is used for the determination of retention curves in undisturbed soil samples (volume of 250 cm3) by using tensiometers and gravimetric method. Undisturbed soil columns can also be used for the monitoring of solute soil transport and leaching. Soil columns support the usage of different sensors, enable the control of precipitation intensity and allow the application of solute in different doses. So far, the most efficient method for monitoring soil transport processes is the use of lysimeters, which allows investigation of solute soil transport in real agroecological conditions and also a continuous monitoring of soil water balance, evapotranspiration and leachate quality. Presented methods are a prerequisite for the estimations of water resources pollution by agrochemicals, as well as for the application of predictive numerical models.

Key words: monitoring, water resources, soil substances transport methodology, hydraulics

Evaluacija izlaznih kapaciteta gnojovke/digestata na umbilikalnom sustavu za aplikaciju

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Sažetak

Intenzivna proizvodnja gnojovke/digestata predstavlja izazov za većinu proizvođača zbog zadovoljavanja agrotehničkih rokova sjetve i žetve ratarskih kultura. Kratak rok za aplikaciju zahtijeva dobru organizaciju i planiranje aplikacije gnojovke/digestata što podrazumijeva evaluaciju izlaznih kapaciteta. Korištenjem Hazen-Williamsove jednadžbe i programa MS Excel, napravljena je evaluacija izlaznih kapaciteta gnojovke/digestata na umbilikalnom sustavu za aplikaciju ovisno o duljini transportnog crijeva od skladišnog kapaciteta gnojovke/digestata do točke aplikacije na oraničnoj površini. Evaluacija je rađena na temelju sustava s 2 pogonske jedinice s dizelskim motorom tipa JD 6090HF485 te pumpama tipa Cornell 61017MP i Cornell 6819MP. Evaluacija podrazumijeva izračun izlaznog kapaciteta sustava koji koristi transportno crijevo promjera 203 mm različitih duljina od 2, 3, 4, 5, 6 i 7 km. Sve opcije sustava podrazumijevaju i korištenje 0,4 kilometra radnog crijeva promjera 140 mm. Evaluacija pokazuje da navedeni sustav ostvaruje najveći kapacitet aplikacije od 465 m^3/h na udaljenosti od 2 km, odnosno najmanji kapacitet aplikacije od 308 m^3/h na udaljenosti od 7 km. Sustav na 5 km udaljenosti ostvaruje izlazni kapacitet od 354 m^3/h što uz projiciranih 12 sati rada/dan i proizvodnju gnojovke/digestata od 100.000 m^3 god. omogućuje završetak aplikacije ukupne projicirane jednogodišnje proizvodnje za 30 dana, 12-14 dana prije proljetne sjetve i 16-18 dana prije jesenske sjetve.

Ključne riječi: evaluacija izlaznog kapaciteta, gnojovka, digestat, umbilikalni sustav za aplikaciju

Evaluation of output capacities of manure/ digestate on the umbilical system for application

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Abstract

Intensive manure/digestate production is a challenge for most producers because of the agrotechnical deadlines of sowing and crop harvesting. A short application window requires good organization and planning of manure/digestate application, which implies the evaluation of output capacities. Using Hazen-Williams equations and MS Excel, manure/digestate output [m3/h] was evaluated on the umbilical application system depending on the length of the transport hose from the manure/digestate storage capacity to the point of application on the arable land. Evaluation was based on a system using two pump units, using JD 6090HF485 diesel engines and Cornell 61017MP and Cornell 6819MP pumps. Evaluation includes calculation of the output capacities of the system using a 203 mm diameter transport hose with different lengths of 2, 3, 4, 5, 6 and 7 km. All system options also include the usage of 0.4 kilometers of working hose with 140 mm diameter. The evaluation shows that the system achieves the highest manure/digestate application capacity of 465 m3/h on the distance of 2 km, while the lowest application capacity of 308 m3/h is achieved on the 7 km distance. The system at a distance of 5 km achieves an output capacity of 354 m3/h which, with projected 12 working hours per day and production of manure/digestate of 100,000 m3 per year, allows completion of the application of the projected one-year production in 30 days, 12-14 days before spring sowing and 16-18 days before autumn sowing.

Keywords: evaluation of output capacities, manure, digestate, umbilical system for application

Prikaz dva modela aplikacije gnojovke/digestata na oranične površine

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Sažetak

Jedan od najvećih izazova u sektorima intenzivne stočarske proizvodnje i proizvodnje energije iz bioplinskih postrojenja je upravljanje nusproizvodima tih industrija, gnojovkom i digestatom. Cilj ovog rada je prikaz dva modela aplikacije gnojovke/digestata na oranične površine, površinska aplikacija cisternama, odnosno model injektiranja umbilikalnim sustavom. Aplikacija cisternama uključuje prijevoz gnojovke/digestata sistemskim vozilom s ugrađenim spremnikom ili traktorom koji vuče cisternu sa spremnikom kao priključno vozilo. Aplikacija cisternom vrši se rasprostiranjem gnojovke/digestata po površini tla, dok se sustavom inkorporiranja gnojovke/digestata na dubinu od 6-15 cm, oruđem za plitku obradu tla, rasprostiranje gnojovke i digestata obavlja u tlo. Uglavnom se inkorporiranje obavlja sustavom diskova. Umbilikalnim sustavom gnojovka/digestat se transportiraju od skladišnog kapaciteta do oranične površine sustavom pumpi i crijeva, a aplikacija se vrši injektiranjem gnojovke/digestata na dubinu od 15–40 cm, traktorom koji nosi ili vuče aplikator. Injektiranjem se postiže značajno smanjenje gubitka dušika prilikom aplikacije, 0-5%, u odnosu na rasprostiranje i inkorporiranje, 60-80%. Kapacitetom i kontinuiranom aplikacijom, injektiranje gnojovke/digestata umbilikalnim sustavom pruža i dodatne prednosti koje se očituju kroz znatno smanjenje zbijanja tla, znatno kraće vrijeme aplikacije i znatno manje financijske izdatke.

Ključne riječi: gnojovka, digestat, rasprostiranje, inkorporiranje, injektiranje

Overview of two models of manure/digestate application on arable land

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Abstract

One of the greatest challenges in sectors of intensive livestock production and energy production from biogas plants is the management of by-products, manure and digestate. Aim of this paper was to present two models of manure/digestate application on arable land, surface application with tanks and injection with umbilical system, respectively. Application using tanks implies transportation of the manure/digestate using system vehicles with a built-in tank or using tractors pulling tank trailers. Application with tanks is carried out by spreading the manure/digestate on the soil surface, while the incorporation system of manure/digestate at a depth of 6-15 cm, with a tool for shallow soil treatment, the spreading of manure and digestate is carried out into soil. With the umbilical system, manure/digestate are being transported from the storage capacity to the arable land using a hose system with pumps, while the application is carried out by injecting the manure/digestate at a depth of 15-40 cm with a tractor that is carrying or pulling the applicator. Injection results in a significant reduction of N losses during application compared to spreading and incorporation, 0-5% and 60-80%, respectively. With capacity and continuous application, injecting the manure/digestate with umbilical system provides additional benefits such as significant reduction in soil compaction, significantly shorter application time, and significantly lower financial costs.

Key words: manure, digestate, spreading, incorporation, injection

Novi genotipovi energetske kulture *Miscanthus sinesis* – karakterizacija biomase nakon žetve u jesenskom roku

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Sažetak

Posljednjih godina, intenzivno se istražuje mogućnost korištenja višegodišnjih trava kao sirovina za proizvodnju energije, a jedna od njih je trava *Miscanthus*. Na temelju znanja stečenih u prethodnim EU projektima, u okviru projekta GRACE razvijeni su novi genotipovi *Miscanthus*-a, koji bolje podnose uzgoj na marginalnim tlima. Stoga je AFZ u proljeće 2018. godine na eksperimentalnom polju Šašinovečki lug, uspostavio nasad (100 m^2 x 4 ponavljanja) s 13 različitih novih hibrida *Miscanthus*-a (8 *M. sinensis* hibrida i 5 *M. sacchariflorus* x *M. sinensis)*, uz *M. x giganteus* kao kontrolni uzorak. Cilj ovog istraživanja bio je utvrditi kvalitetu biomase požete u jesen prve vegetacijske sezone. U tu svrhu uzeto je u obzir 8 hibrida *M. sinensis* za analizu. S obzirom na rani rok žetve, sadržaj vode u biomasi bio je nešto veći, s vrijednostima od 65,00 %-70,14 %. Utvrđeno je da je sadržaj pepela u rasponu od 4,54 %-6,00 %, sadržaj hlapive tvari kreće se u rasponu od 67,94 %-80,08 %, a Cfix od 7,52 %-11,66 %. Nadalje, utvrđena je ogrjevna vrijednost u rasponu od 18,69 MJ/kg-21,57 MJ/kg. Imajući na umu vrijeme žetve, bilo je za očekivati veći sadržaj vode, ali i pepela. Međutim, drugi parametri ukazuju na to da je istraživana biomasa prihvatljiva za proces izravnog izgaranja, stoga je potrebno nastaviti pratiti njihovu kvalitetu, imajući u vidu kasnije rokove žetve.

Ključne riječi: *Miscanthus sinesis*, novi genotipovi, karakterizacija biomase, jesenska žetva

Ovo istraživanje financirala je Europska komisija i *Bio-based Industries* konzorcija putem Obzor 2020 BBI-DEMO projekta br. 745012 *„GRowing Advanced industrial Crops on marginal lands for biorEfineries - GRACE”.*

New *Miscanthus sinesis* genotypes – characterization of biomass harvested in autumn

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Abstract

In the last decade, several perennial grasses have been studied as feedstock for energy production due to high lignocellulosic production, and one of them being *Miscanthus*. Based on the knowledge gained by the previous EU projects, new *Miscanthus* varieties were developed within the project GRACE, with better performance under marginal conditions. Hence, in spring 2018, FAZ has established a Plot scale (PS) trial (100 m^2 x 4 reps) on its Experimental field Šašinovečki lug, with 13 different *Miscanthus* hybrids (8 *M. sinensis* hybrids, and 5 *M. sacchariflorus* x *M. sinensis* hybrids), and *M. x giganteus* as control. The objective of this study was to determine the quality of biomass, harvested in autumn of the first vegetation season. For this purpose, 8 *M. sinensis* hybrids were taken into account for the analyses. Considering the early harvest, moisture content was somewhat higher, with values from 65.00 %-70.14 %. Ash content was found to be in the range from 4.54 %-6.00 %, with volatile matter ranging from 67.94 %-80.08 %, and Cfix from 7.52 %-11.66 %. Calorific value was found to be in the range from 18.69 MJ/kg-21.57 MJ/kg.Having in mind an early harvest date, it was expected that the moisture content would be somewhat higher, as well as the ash content. However, other parameters, along with calorific value define the investigated biomass as acceptable when considering it for direct combustion process, and should be further monitored, having in mind alternative harvest times.

Key words: *Miscanthus sinesis*, new genotypes, biomass characterization, autumn harvest

The research was financed by the European commission and Bio-based Industries consortium *via* H2020 BBI-DEMO project No. 745012 *„GRowing Advanced industrial Crops on marginal lands for biorEfineries - GRACE".*

Novi genotipovi roda *Miscanthus* - tehnologija podizanja nasada za potrebe prerade do bioproizvoda

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Sažetak

Energetska kultura *Miscanthus x giganteus* trenutno je jedna od kultura u EU čiji je uzgoj namijenjen proizvodnji biogoriva i bioproizvoda, no kao takva ima određenih nedostataka s aspekta otpornosti i produktivnosti uzgoja na tako širokom geografskom području. Razvoj novih genotipova ključan je za prevladavanje tih nedostataka. U ovome radu, prikazan je proces uspostave pokusnog nasada - od izolacije sjemenog sadnog materijala do određivanja primitka novih genotipova roda *Miscanthus* (genotipovi *M. sacchariflorus x M. sinensis* i *M. sacchariflorus x M. sinensis*). Podizanje pokusnog nasada prilagođeno je zahtjevima sadnog materijala, površine te komercijalno dostupnoj opremi. Rezultati korištenih tehnologija predstavljaju prilagodljivost sadnog materijala novih genotipova, kako na agroklimatološke uvjete pokusnog polja, tako i na prilagođene tehnologije uzgoja. Genotipovi *M. sacchariflorus x M. sinensis* pokazali su veći primitak te samim time bolju prilagodljivost uzgoju na odabranim tlima i u danim agroklimatološkim uvjetima, u odnosu na genotipove *M. sinensis x M. sinensis*. Prikazana tehnologija podizanja pokusnog nasada pokazala se zadovoljavajućom, no potrebno je unaprijediti određene korake tijekom same izvedbe.

Ključne riječi: *Miscanthus*, novi genotipovi, uspostava pokusnog nasada

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New *Miscanthus* genotypes – technology of plantation establishment for conversion to bioproducts

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Abstract

Currently, energy crop *Miscanthus x giganteus* is one of the crops which cultivation is dedicated to the production of biofuels and bioproducts in EU; however, it has certain disadvantages in terms of resistance and growth productivity in such a wide geographical area. Development of new genotypes is essential to overcome these shortcomings. This work presents a complete trial plantation establishment - from seeds' isolation to survival rate determination of new *Miscanthus* genotypes (*M. sacchariflorus x M. sinensis* and *M. sacchariflorus x M. sinensis* genotypes). Trial plantation establishment was adapted to planting material and soil requirements, and commercially available equipment. The results of used technologies represent the new genotypes planting materials' adaptability, both to agro-climatic conditions of the experimental field and to the customized planting technologies themselves. *M. sacchariflorus x M. sinensis* genotypes showed higher survival rate and thus better adaptability to selected soils and agro-climatological conditions compared to *M. sinensis x M. sinensis* genotypes. Presented establishment technology has been satisfactory, but certain steps need to be improved during the performance itself.

Key words: *Miscanthus*, new genotypes, trial plantation establishment

The research was financed by the European commission and Bio-based Industries consortium *via* H2020 BBI-DEMO project No. 745012 *„GRowing Advanced industrial Crops on marginal lands for biorEfineries - GRACE".*

Miskantus i poljoprivredni ostaci kao sirovina za proizvodnju naprednih biogoriva

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Sažetak

Direktiva o obnovljivoj energiji (RED II), objavljena u srpnju 2018., propisala je ciljeve za primjenu obnovljivih izvora energije, kojima obvezuje dobavljače goriva da postignu 14 % energije iz obnovljivih udjela u svom portfelju. Cilj za plasiranje naprednih biogoriva postavljen je na 0,2 % energije u 2022., 1 % energije u 2025. i 3,5 % energije u 2030., a sadržaj energije se broji dvostruko prema ukupnom cilju za napredna biogoriva. INA, kao distributer goriva, ima obvezu namješavati biogoriva te pridonositi ispunjenju propisanih ciljeva te stoga razmatra mogućnost proizvodnje naprednog bioetanola.

Cilj ovog rada je dati uvid u trenutno stanje i mogućnosti proizvodnje naprednog bioetanola u Hrvatskoj, s fokusom na razvoj lanca opskrbe sirovinom. Poljoprivredni ostaci, kao što su razni tipovi slame i kukuruzovina, zajedno s energetskom biljkom *Miscanthus x giganteus*, razmatraju se kao obećavajuća sirovina za proizvodnju naprednog bioetanola. Rad će također dati uvid u projekt GRACE, financiran od strane Europske komisije i BBI, trajanja pet godina. Cilj ovog projekta je demonstrirati uzgoj Miscanthusa na tri skale testiranja te njihovu prikladnost za uzgoj na marginalnom, kontaminiranom i neiskorištenom tlu. Zaključci ovog projekta pomoći će razvoju komercijalnog opskrbnog lanca energetskih kultura te uvesti Miscanthus u poljoprivredu u širem rasponu. Trenutno ne postoji komercijalna proizvodnja Miscanthus-a, niti proizvodnja naprednih biogoriva u RH.

Ključne riječi: RED II, napredna biogoriva, slama, Miscanthus, GRACE

Miscanthus and agricultural residues as a feedstock for advanced biofuels production in Croatia

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Abstract

Renewable energy directive (RED) II, published in July 2018 has defined a new set of goals for renewable energy application. RED II obliges fuel suppliers to achieve 14 % of renewable energy share in their fuel portfolio. Target for advanced biofuels is set as 0.2 % of energy in 2022, 1 % of energy in 2025 and 3.5 % of energy in 2030, while energy content counts double towards overall advanced target. INA, as a fuel distributor, has obligation to blend biofuels to contribute to prescribed targets, so production of advanced bioethanol is being considered as an option.

Aim of this paper is to present current status and possibilities for advanced bioethanol production in Croatia, with focus on feedstock supply chain development. Agricultural residues, such as various types of straw and corn stover, together with energy crop *Miscanthus x giganteus* are being monitored as most promising feedstock for advanced bioethanol production in Croatia. Paper will also give more insight on running EU BBI funded GRACE project. The objective of this five year project is to demonstrate the up scaling of crop production of Miscanthus and its suitability for marginal, contaminated and unused land. Conclusions of this research project will help in developing commercially viable energy crops cultivation and supply chain, and introduce Miscanthus to Croatian agriculture on broader range as a feedstock for advanced biofuels production, which is non-existent in Croatia at this moment.

Key words: RED II, advanced biofuel, straw, Miscanthus, GRACE

Dostupnost poljoprivredne biomase za proizvodnju naprednih biogoriva u Hrvatskoj

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Sažetak

Saznanja o dostupnosti biomase za napredna biogoriva u Hrvatskoj su značajna s aspekta uvida u mogućnosti njihove proizvodnje. Stoga je cilj ovog istraživanja bio analizirati dostupnost biomase kukuruza, pšenice, ječma, raži, soje, uljane repice i suncokreta, temeljem podataka iz zahtjeva za potporu koje poljoprivrednici podnose na godišnjoj razini. Istraživanjem su obuhvaćene četiri proizvodne godine (2016.-2018.). U radu su obrađeni podaci o konvencionalnoj proizvodnji, ali i ekološkoj proizvodnji promatranih kultura, koja je količinski značajno niža. Najveće proizvodne površine zauzima kukuruz, zatim pšenica i soja. Ječam i uljana repica uzgajaju se u sličnom obimu površina ovisno o pojedinoj godini, dok su površine pod suncokretom i raži najmanje. Prostorna distribucija površina pod promatranim kulturama ukazuje da su najveće površine smještene na istoku Hrvatske što izravno upućuje na to da je opravdano proizvodnju naprednih biogoriva organizirati na tome području. Površine na kojima se uzgajaju istraživane kulture zauzimaju 57,9 % ukupnih poljoprivrednih površina u konvencionalnoj proizvodnji što ukazuje na visoku vrijednost biomase koja je dostupna i može se koristiti za proizvodnju naprednih biogoriva.

Ključne riječi: biomasa, Hrvatska, napredna biogoriva, uljarice, žitarice

Availability of agricultural biomass for production of advanced biofuels in Croatia

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Abstract

Knowledge of biomass availability for advanced biofuels in Croatia is significant from their production potential point of view. Therefore, the purpose of this study was to analyze the availability of biomass of maize, wheat, barley, rye, soybean, rapeseed and sunflower, based on the data from support requests submitted by farmers on an annual basis. The study has covered four production years (2016-2018), and deals with conventional production and ecological production of observed crops, the latter being significantly lower in quantity. As expected, maize occupies the largest production area, followed by wheat and soybeans. Barley and rapeseed are grown on a similar production area, depending on the particular year, whereas the production areas covered by sunflower and rye are the smallest. The spatial distribution of area under the observed crops indicates that the largest production areas are located in the eastern part of Croatia, which directly indicates that it is justified to organize the production of advanced biofuels in that specific area. Production areas covered by crops analyzed in this study account for 57.9 % of total agricultural land in conventional production, which indicates the high availability of biomass for production of advanced biofuels.

Key words: biomass, Croatia, advanced biofuels, oilseeds, cereals

Inicijativa za obrazovanje o otpadu - istraživanje za osnovne škole grada Zagreba

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Sažetak

EU je prepoznala potrebu za edukacijom vezanom uz gospodarenja otpadom te u sklopu *Erasmus+* projekta "*Waste Education Initiative*" financira razvoj obrazovnih programa u ovom području. Glavna smjernica je činjenica da se djeca trebaju obrazovati u ranoj fazi, kako bi bili osviješteni o pravilnom načinu gospodarenja otpadom. Cilj ovog rada bio je utvrditi voljnost nastavnika osnovnih škola Zagreba za dodatno angažiranje u obrazovanju o gospodarenju otpadom. Anketni upitnik proveden je od 19. rujna do 19. listopada 2018. Pristiglo je ukupno 117 odgovora i to profesora biologije, kemije i fizike ili koordinatora eko škola.

Naime, 73,5 % sudionika ankete su nastavnici u eko školama. Prema nastavnom programu potrebno je educirati djecu o obnovljivoj energiji i gospodarenju otpadom, općenito. 48,7% učitelja ima neke materijale osigurane od strane stručne ustanove. Vanjski stručnjaci za otpad posjetili su 46,2 % škola. Kod većine škola postoji organizirano odvojeno prikupljanje otpada (67,5%). Kako bi se poboljšala organizacija odvojenog prikupljanja otpada, nastavnici trebaju dodatnu materijalnu (76,1 %) i financijsku potporu (39,3 %). Smatraju da veća osviještenost o ovoj temi (75,2 %), odgovorno postupanje s otpadom u domu učenika (69,2 %) i osiguranje prikladnih spremnika (66,7 %) mogu poboljšati upravljanje otpadom u njihovoj školi. Učitelji vjeruju (77,8 %) da će nakon obrazovanja, u budućnosti, djeca imati veće razumijevanje o potrebi preuzimanja odgovornosti za upravljanje otpadom.

Ključne riječi: otpad , obrazovanje, osnovne škole, anketni upitnik

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Waste education initiative – a case study for primary schools in the city of Zagreb

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Abstract

Project "Waste Education Initiative" is EU coordinated effort to identify the current state of waste education in the school curriculum. As future EU citizens, school children should be educated at an early stage, to make adults aware of proper waste disposal. The aim of this research was to determine the willingness of primary school teachers from the city of Zagreb for additional engage in waste management educating. A questionnaire was conducted from September to October 19th, 2018. There were 117 responses mostly professors of biology, chemistry and physics or eco school coordinators.

Namely, 73.5 % of the participants in the survey are teachers in eco schools. According to the curriculum they need to educate children about renewable energy and waste management in general. 48.7 % of teachers have some materials provided by a professional institution. External waste experts visited 46.2 % of schools. Most schools already have organized separate waste collection (67.5 %). To improve organization of separate waste collection, teachers need additional materials (76.1 %) and financial support (39.3 %). They think that more awareness of the topic (75.2 %), responsible handling of waste at student's home (69.2 %) and provision of appropriate containers (66.7 %) can improve waste management at their school. Teachers believe (77.8 %) that after education, schoolchildren will have an increased understanding of the need to take responsibility for waste management in the future.

Key words: Waste, education, primary schools, questionnaire

The research was financed by the ERASMUS+ programme, project "Waste Education Initiative".

The economic and environmental performance of miscanthus cultivated on marginal land for biogas production

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Abstract

In the last years there is a growing interest in alternative biogas crops, such as miscanthus. One important reason for that is their better environmental performance compared to conventional annual biogas crops such as maize. In addition, miscanthus can be grown on marginal land, where no feed and food crops are cultivated. However, one drawback of the cultivation on marginal land is significantly lower biomass yield compared to quality agricultural land. This raises the question if it makes sense from an economic and environmental point of view to cultivate miscanthus on marginal land as a biogas substrate.

In order to assess the environmental and economic performance of miscanthus cultivated on marginal land for biogas production a LCA and complementary LCC analysis was conducted. The functional unit chosen was 1 GJ of electricity (GJel.). To include the substitution of a fossil reference a system expansion approach was applied.

The electricity generated by the combustion of miscanthus-based biogas in a CHP has compared to the fossil reference considerably lower impacts on the environment in most of the categories assessed. In addition the costs of miscanthus-based biogas generation and utilisation are considerably lower than those of maize.

This results clearly show that it can make economic and environmental sense to cultivate miscanthus on marginal land as a biogas substrate. Hereby the economic sustainability is limited by the biomass yield. In contrast to this, the study showed no clear thresholds limiting the environmental performance.

Key words: Life-Cycle Assessment, Life-Cycle Costs, miscanthus, marginal land, biogas

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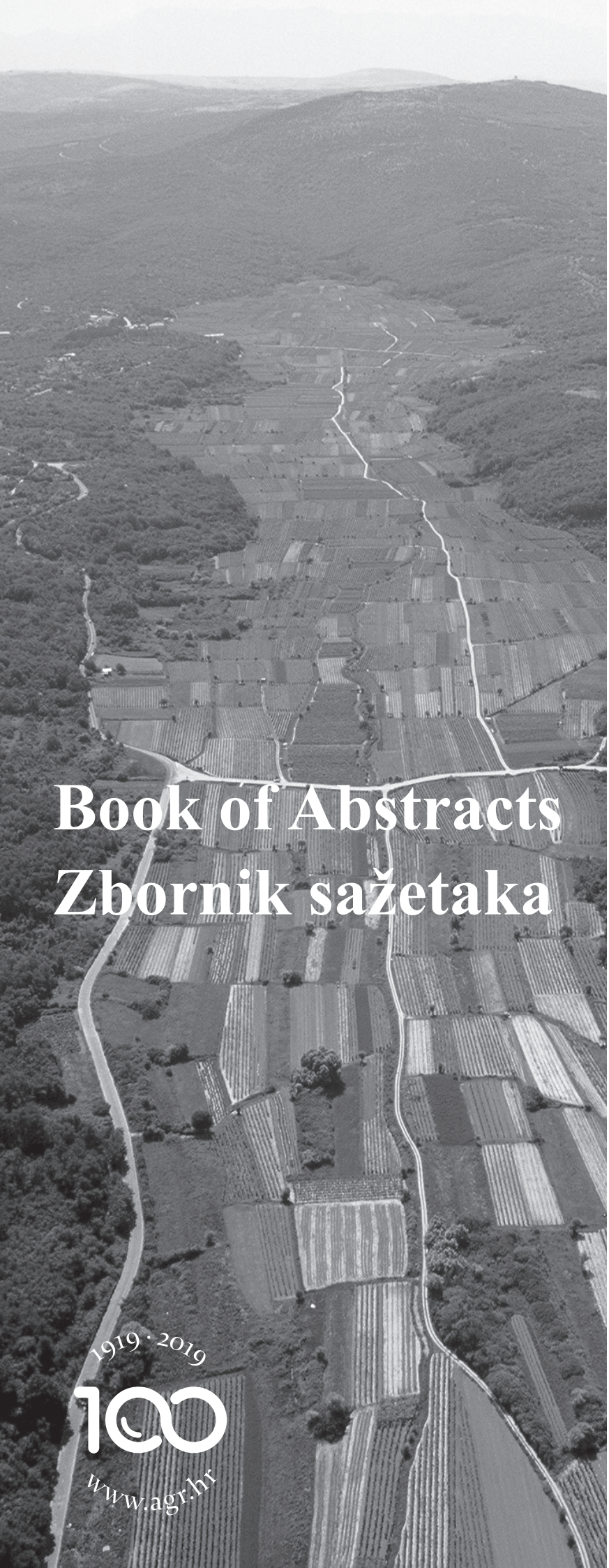

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