



Green Room and University of Montenegro



GREEN ROOM SESSIONS 2018

**International GEA (Geo Eco-Eco Agro) Conference
1-3 Novembar 2018, Podgorica, Montenegro**

**Plant production, Plant protection & Food safety, Genetic resources
Phytochemistry and Medicinal Plants, Animal husbandry and Dairy production
Rural development and agro-economy, Rural Environments and Architecture
Environment protection and natural resources management, Forestry**

GREEN ROOM SESSIONS 2018

Book of Abstracts



Podgorica, Montenegro, 2018

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BOOK OF ABSTRACTS

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FOREWORD

Green Room Sessions International Conference aims to be platform for international scientific discussion on agriculture in general as well as agriculture in conjunction with economics and ecology, food and nutrition science and technology, rural development, environment and forestry. Green Room Sessions brings together and is connecting research, industry, social concepts and practices. The scientific core is based on applying Eco-Eco (ecological-economical) concepts and principles to optimize interactions between natural, social and built components of the rural environments: plants, animals, soil, water, air, humans and man-made structures. In addition, Green Room Sessions will place social issues at the centre of solutions for a sustainable and fair food system. Green Room Sessions are targeting to multiple benefits to society and the environment, by bringing people together and providing them the opportunity to sit together and exchange ideas and connect the business.

In November 2018, the 1st Green Room Sessions International Conference will provide an opportunity to share experiences and build the evidence base on agriculture, forestry, human interactions and built environment, as well as reaching a consensus on the priorities for achieving more sustainable food systems. It also endorsed Institutional roles of National services, Regional and International organisations in supporting further implementation and promotion of Eco-Eco (ecological-economical) concepts and principles.

Dialogue between the participants will target:

- Enhancing smallholder and family farmers' adaptation and resilience to the impacts of climate change;
- Improving nutrition including through more diversified diets;
- Protecting and enhancing agro-biodiversity in support of ecosystem services;
- Improving livelihoods in rural areas;
- National Food Wealth, the holy trinity: agriculture, economics and ecology (a x e2).

Mutual interconnections and how to deal with them and how this mix influence National Food Wealth and National Health.

achieving a transformative change in agricultural practices towards sustainable development.

The Green Room Sessions International Conference will synthesize and build on the outcomes of the regional meetings, and provide an opportunity to share and discuss policies that can help scale-up and scale-out agriculture, rural development, agroecology, nutrition in order to achieve the Sustainable Development Goals.

The Symposium will also move the topic of agriculture and rural development from dialogue to activities at the regional and country level by complementing on-going initiatives to integrate biodiversity and ecosystem services in agriculture, identifying opportunities for synergies with National Strategic Programmes and Regional Initiatives, and facilitating regional and International cooperation between the scientists and business.

Green Room Sessions International Conference as a final goal is looking forward to assist people from the rural areas, related business, agriculture and allied sectors to take the advantage of:

- Natural resources, secure access to land and water, and improved natural resource management and conservation practices;
- Improved agricultural technologies and effective production services;
- Linking the interested parties with financial services;
- Transparent and competitive markets for agricultural inputs;
- Opportunities for rural off-farm employment and enterprise development;
- Local and national policy and programming.

We launch this with the aim of unlocking innovative, integrated, multidisciplinary science and technology with activation of all dimensions of sustainable development goals for all the participants.

Finally, we welcome you to Podgorica and Montenegro, nice destination for international travellers. We hope that you will take advantage of the many sights to see in Montenegro, as well as the many natural wonders nearby, during your stay.

Velibor SPALEVIC

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Predgovor

Međunarodna konferencija Green Room Sessions ima za cilj da bude platforma međunarodne naučne diskusije o poljoprivredi uopšte, poljoprivredi vezano sa pitanjima ekonomije i ekologije, nauci o tehnologiji hrane i prehrane, ruralnim razvojem, životnom sredinom i šumarstvom. Green Room Sessions okuplja i povezuje nauku, istraživanje, industriju, društvene koncepte i prakse.

Naučni principi zasnovani su na primjeni Eko-Eko (ekološko-ekonomskih) koncepata za optimizaciju interakcije između prirodnih, socijalnih i komponenti ruralnih sredina: biljka, životinja, zemljište, voda, vazduh, kao i strukture koje su nastale kao plod rada ljudi. Pored toga, Green Room Sessions će težiti da postavi društvena pitanja u centar rješenja održivog i fer sistema proizvodnje hrane. Očekivanja su da brojni sastanci održani na Konferenciji imaju višestruke koristi za društvo i sredinu koja nas okružuje, približavajući tokom ovih komunikacija ljude jedne drugima, pružajući im priliku da međusobno komuniciraju na jednom mjestu, razmenjuju ideje i povezuju poslovanja.

U novembru 2018. godine, Prva (1.) Green Room Sessions International Conference pružiće mogućnost razmjene iskustava potvrđenih praksi u poljoprivredi, šumarstvu, interakcijama čovjeka i njegovog okruženja, struktura koje su nastale kao plod rada ljudi. Očekujemo da ćemo organizovanjem susreta naučnika i stručnjaka iz ove oblasti, te razmjenom iskustava, doprinijeti unapređenju održivijeg sistema proizvodnje i prerade. Iskustva drugih koji će gostovati kod nas će istaći značaj institucionalne uloge nacionalnih službi, regionalnih i međunarodnih organizacija u podršci i daljoj promociji eko-eko (ekološko-ekonomskih) koncepata i principa.

Dijalog između učesnika će biti usmjeren na:

- Prilagođavanje malih proizvođača i porodičnih farmera i jačanje njihove otpornosti na uticaj klimatskih promjena;
- Zaštitu i unapređenje agro-biodiverziteta kao podrška održivosti ekosistema;
- Poboljšanje životnih uslova, životnog standarda u ruralnim područjima;
- Sveto trojstvo: poljoprivreda, ekonomija i ekologija (a x e2), njihove međusobne veze i kako se baviti njima, te kako ovaj miks međusobnih relacija utiče na proizvodnju domaće hrane i zdravlje nacije;
- postizanje transformativne promjene u poljoprivrednim praksama u skladu sa principima održivog razvoja.

Konferencija će dijelom uraditi sintezu i nadograđivati rezultate regionalnih sastanaka i pružiti priliku da podijeli svoja iskustva sa učesnicima, diskutuje o politikama koje mogu pomoći u povećanju poljoprivredne proizvodnje, ruralnog razvoja, agroekologije, ishrane kako bi se postigli ciljevi održivog razvoja.

Konferencija će takođe inicirati pomjeranje teme poljoprivrede i ruralnog razvoja od dijaloga ka konkretnim aktivnostima na lokalnom i regionalnom nivou (kod nas u Crnoj Gori), tražeći rješenja očuvanja biodiverziteta u poljoprivredi, identifikujući mogućnosti za sinergiju sa nacionalnim strateškim programima i regionalnim inicijativama, pospješujući regionalnu i međunarodnu saradnju između naučnika i biznisa.

Konačni cilj je traženje načina da se pruži pomoć ljudima iz ruralnih područja, njihovim malim biznisima, poljoprivredi i srodnim sektorima da iskoriste prednosti:

- Prirodnih resursa, bezbjednog pristupa zemljištu i vodama, poboljšavajući prakse upravljanja prirodnim resursima i pristupe konzervacije;
- Poboljšane poljoprivredne tehnologije i efikasnijih proizvodnih usluga;
- Povezivanje zainteresovanih strana sa finansijskim servisima;
- Mogućnosti za zapošljavanje i razvoj preduzeća u ruralnim područjima;
- Lokalnih i nacionalnih politika i programiranja.

Ovo inicijativa je pokrenuta sa ciljem otvaranja i susreta sa inovativnom, integrisanom, multidisciplinarnom naukom i tehnologijom uz aktiviranje svih dimenzija ciljeva održivog razvoja za sve učesnike.

Na kraju, želimo vam dobrodošlicu u Podgorici i Crnoj Gori, zanimljivoj destinaciji za međunarodne putnike. Nadamo se da ćete za vrijeme vašeg boravka iskoristiti priliku i da posjetite neke od mnogih znamenitosti Crne Gore.

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(1) Plant production

Mediterranean citrus industry: biodiversity, socio-economic importance and challenges threatening its future sustainability

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Abstract

Production of citrus in the Mediterranean Basin exceeds 25 million tons per year. This region ranks the second largest citrus producer in the world and is by far the first exporter of citrus fruit for fresh consumption. Climatic condition of the Mediterranean area are highly suitable for citrus farming and permit production of outstanding quality both for internal taste as well as good cosmetic aspect of the fruit. Mediterranean citrus comprise an opulent range of species and varieties covering the entire biodiversity known to this species worldwide. With these multiple assets, Mediterranean's have developed a variety of utilisations of citrus for fresh consumption, special diets, refreshment, cosmetics, and medication. This living treasure is however facing arduous challenges including climate change, water quality depletion and scarcity, and new emerging diseases. Coordinated efforts from all countries of this region are needed to preserve Mediterranean citriculture for future generations.

Key words: Mediterranean citriculture, biodiversity, climate change, new emerging diseases.

**** Key Note papers / Green Room Sessions 2018 International Conference Invited speaker**

Advances in pomegranate cultivation in Iran

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Abstract

Pomegranate as one the oldest edible fruit is native to Iran and surrounding area. In the last decade tremendous increase in trading of pomegranate and its products was recorded at the local and regional markets due to the promoting effects. Iran has variety of wild and cultivated pomegranate with grate diversity of tastes, colour and fruit appearances throughout the country, adopted with different physical-geographical and climatic conditions. This review presents experiences on how pomegranate is propagated in Iran and practices in relation to the establishment and management of the pomegranate orchards; innovative methods and practices of the growers in control of carob moth, the most devastating pest of pomegranate fruit and all the other high-value crops. Finally, the review presents local and international experiences on dealing with pomegranate cultivars and their fruit growth including the postharvest management. The specific recommendations targeted relevant stakeholders: farmers, technicians, agricultural services and policy makers, all based on the experimental evaluation of different agricultural practices and a socio-economic analysis of local and global production and markets.

Key words: Pomegranate, trading of pomegranate, pomegranate propagation, orchards, carob moth, cultivars postharvest management.

**** Key Note papers / Green Room Sessions 2018 International Conference Invited speaker**

Effect of different types of fertilizers on onion production

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Abstract

Field micro-experiment was performed in the area of Zeta plain, village Golubovci with the aim of testing several types of fertilizers and their effect on onion production. Examined factor (fertilizer), was analyzed by application of six different types of fertilizers: Chap liquid – Bio Plant Booster + 12,20 – 1,05-4,45, NPK 24:08:17 + MicroE, NPK 15:30:20 + MicroE, SUPREMO W 15/5/30 + ME, EM NATURAL AKTIV and Pepton 85/16. Experiment was performed by method of random disposition in three receptions. Fertilizers are applied after germination and after forming the first three real leaves. Sampling for research started twenty days before onion harvesting and on that samples (six random selected plants for all examined types of fertilizers and control variant from every reiteration) measurements were made for several parameters: plant height, plant mass, leaves mass, number of leaves, but after bulb harvesting we sampled-bulb mass, vertical bulb diameter, horizontal bulb diameter, bulb shape index and estimated bulb yield. After measuring we came to the conclusion that the best results by most average values of the parameters such as plant mass (148.7 g), leaves mass (85.7 g) number of leaves (11), bulb mass (124.3 g), horizontal bulb diameter (7.4 cm) and yield (18.64 t/ha) indicated fertilizer SUPREMO W 15/5/30 + ME, which points on, that this fertilizer showed significant statistic difference with regard to the rest examined fertilizers, depending on the parameter.

Keywords: onion, production, fertilizers

The effectiveness of growing measures within conventional and advanced maize cultivation

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Abstract

Maize is a row crop with growing cycle from spring to autumn which makes weeds as limiting factor in production, especially when herbicides are not properly applied. The conventional maize production in Serbia means sowing on 70 cm row distance, application of standard forms of nitrogen, and pre-emergence herbicide treatment. The advanced technology for modern maize hybrid production that includes sowing with 50 cm row distance and slow-realizing urea and post-emergence herbicide application, was tested.

The experiment was conducted in the MRI Zemun Polje, Belgrade, during 2014-2016. Maize newly developed hybrid ZPSC 388 was sown with the application of standard urea and slow-realizing urea (triamid UTEC (n-butyl) tiofosfat (NBPT), Eurochem Agro, Germany), both applied at the beginning of maize development. Within each N source, maize was grown with 50 cm and 70 cm row spacing. The herbicide treatments included: control with no herbicides, a pre-emergence treatment of S-metolachlor+mesotrione (960 g ha⁻¹ + 120 g ha⁻¹ a.i.) and post-emergence application of nicosulfuron+mesotrione (40 g ha⁻¹ + 120 g ha⁻¹ a.i.). Three weeks after herbicides application, the dry biomass of uprooted weeds from 1 m² (DBW) was measured, while maize harvest index (HI) and grain yield (GY), were evaluated when plants were fully matured.

The DBW as well as HI and GY of maize were highly dependent on the meteorological conditions. Statistical analysis showed that average DBW was significantly lower in the post-emergence treatment (33.6%) than with pre-emergence application of herbicides, while row spacing and urea form did not affect weed infestation level. The HI and GY have been influenced significantly only by maize row spacing and reached higher values in 70 cm (for 4.7% and 19.9%, respectively). Results indicate that, despite weed biomass reduction, maize in Serbia still should be grown with 70 cm row spacing in order to achieve high biomass and grain yield.

Key words: Maize, conventional cultivation, advanced maize cultivation

The effect of cover crops on the weediness, productivity and quality of popcorn (*Zea mays* L. ssp. *everta*)

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Abstract

Providing land cover from the aspect of protection of crops from weeds, diseases and pests and reduced use of pesticides, improvement of the structure and soil regime of the soil, as well as storing of moisture reserves in the soil are the main advantages of growing cover crops. In addition, it often happens that with such a method of growing we obtain more yields of crops compared to the conventional cultivation method.

Experiments with cover crops were carried out at the Maize Research Institute in Zemun polje, on the chernozem soil type during 2013/14, 2014/15 and 2015/16 growing seasons. The experiment included four treatments with winter cover crops (common vetch-V1, oat V2, fodder kale-V3 and field pea-V7), mixtures of legume crops with oats-V4 and V6), another variant in which the land was covered with dead organic mulch (V5), and traditional variant, classical ploughing in the fall and keeping bare land uncovered during the winter (V8). The experiments were located in different plots in each year and winter wheat was the previous crop. In the autumn, before planting of cover crops, we have entered the entire amount of P and K in the forms of monopotassium phosphate plus additional quantity of nitrogen 50 kg/ha by ammonium nitrate, and on the two control variants, also all of P₂O₅ i K₂O and 40 kg ha⁻¹ N in the form AN. In the next spring (May) leguminous cover crops had received another 30 kg ha⁻¹ N in the form of AN (remaining 40 kg ha⁻¹ considered to be provided by nitrogen fixation), oats and fodder kale 70 kg ha⁻¹ N, and control plots another 80 kg ha⁻¹ N, also in the form of AN. Sowing of cover crops were done manually in the last of October or at the beginning of November. Mowing the above-ground biomass of winter cover crops were performed 7-10 days before planting of popcorn.

The legume cover crops expressed greater efficiency in weed control in comparison to different cropping systems. The highest yields of popcorn were achieved in 2014, especially on variants V4 (5.41 t ha⁻¹), V3 (5.26 t ha⁻¹) and V1 (5.11 t ha⁻¹), but these values are also very small compared to the potential of hybrid ZP 611k. The results of grain yields in 2015 and 2016 were significantly lower (3.99 and 4.14 t ha⁻¹); primarily due to meteorological conditions, and in these years a higher moisture content in seed was measured (14.85 % and 14.6 %). The average popping expansion in these studies is equalized by years of investigation, significantly lower (24.53 %) compared to which this hybrid reached earlier (35-40%). Achieving the full effect of such growing system is possible if sowing is done at optimum time, because it is a hybrid of specific properties that is more sensitive to the competitive of weeds.

Key words: Crops, weediness, productivity, quality, popcorn, *Zea mays*

The impact of grape variety on chemical composition and sensory properties of grape brandy

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Abstract

The paper presents the results of a study that examined the impact of variety on chemical composition and sensory properties of standard and muscat grape brandy in Podgorica subregion (Montenegro) in 2010, 2012 and 2013. The brandies were prepared by distillation of the crashed grapes – marc, from the autochthonous varieties Vranac and Kratosija and Muscat grapes, in a traditional copper alembic, under the same conditions. A chemical and gas-chromatographic analysis and sensory properties evaluation of brandies were carried out in order to determine the typical characteristics of the examined brandies.

Research results have shown that variety has a significant impact on chemical composition and sensory properties of brandy. All brandies showed typical characteristics of Montenegrin brandy such as ethanol, methanol, total extract, higher alcohols, total acids, volatile esters, volatile aldehydes and furfural, and all of them meet EU requirements. Sensory analyses showed that all brandies belong to the category of high quality brandies.

Key words: grape brandy, muscat brandy, Vranac, Kratosija, Muscat grape varieties

Alfalfa response to seed pre-inoculation with *Sinorhizobium meliloti*

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Abstract

In the process of legume seed pre-inoculation by bioinoculants, proper inoculant formulations with good stick characteristics and ability to provide long survival of rhizobial bacteria on stored seeds are required. In this study the ability of different liquid rhizobial inoculants to be used for alfalfa seed pre-inoculation was tested and compared to seed inoculation performed at the time of sowing. Two strains effective in nitrogen fixation with alfalfa, *Sinorhizobium meliloti* L4 and L5, and four types of inoculant carriers (yeast mannitol brought-YMB, YMB with the addition of 0.5% agar, 0.5 % sodium-alginate, or 1% polyvinylpyrrolidone) were tested. The alfalfa seeds (cultivar Krusevacka K-28) were inoculated 2 and 1 month before sowing (pre-inoculation) and just prior to sowing (inoculation). The effects of pre-inoculation and inoculation of alfalfa seeds on plant nodulation, plant height, shoot dry weight (SDW) and nitrogen content were evaluated. Results showed that the time of pre-inoculation and inoculant formulation as well as their interaction had highly significant influence ($p<0.001$) on SDW and total nitrogen content of plants, while rhizobial strain influenced total nitrogen content ($p<0.05$). In addition, interaction of time of pre-inoculation, inoculant formulation and strain influenced total nitrogen content ($p<0.01$). Inoculant containing YMB as well as inoculants with the addition of 0.5% agar and 1% polyvinylpyrrolidone provided good nodulation of alfalfa pre-inoculated by both strains 2 months before sowing. Depending on the strain, effective nitrogen fixation in alfalfa was reached by YMB inoculant with L4 strain as well as inoculant with addition of 0.5% agar and L5 strain. Our findings indicated that the application of appropriate combination of medium formulation and strain is successful for alfalfa seed pre-inoculation.

Key words: alfalfa, *Sinorhizobium meliloti*, pre-inoculation, liquid inoculants, inoculant carrier.

Possibility to use degraded seed production stands for further forage provision

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Abstract

Degraded seed production stands of some legumes (white clover, sainfoin, birdsfoot trefoil and alfalfa) to be used for further forage provision after under sowing with subclover was studied in field trials. Three subterranean clover subspecies were used: *Tr. subterraneum* ssp. *brachycalycinum* (cv. "Antas"), *Tr. subterraneum* ssp. *yananicum* (cv. "Trikkala") and *Tr. subterraneum* ssp. *subterraneum* (cv. "Denmark"). The under sowing with clovers was performed during the autumn of the fourth year of using of legume seed production stands with 400 germinated seeds/m² and interrow spacing of 12 cm. It was found that subterranean clover contributed to reduce the weed infestation (for alfalfa two- and three fold), did not negatively effect the crop development, and increased dry mass productivity. It is concluded that the under sowing of degraded seed production stands with subterranean clover is possible agro technical measurement. This measurement is considered as responsible to the challenges of agriculture nowadays for bigger resource use efficiency.

Key words: seed production, white clover, sainfoin, birdsfoot trefoil, alfalfa

Effects of fertilization on production traits of winter wheat

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Abstract

The wheat cultivar used in the experiment was Kruna. This investigation included an untreated seven variants of fertilization: 1-control, 2-80 kg/ha N, 3-60 kg/ha P₂O₅, 4-80 kg/ha N, 60 kg/ha P₂O₅, 5-80 kg/ha N, 100 kg/ha K₂O, 6-80 kg/ha N, 60 kg/ha P₂O₅, 60 kg/ha K₂O and 7-80 kg/ha N, 100 kg/ha P₂O₅, 60 kg/ha K₂O. Total amounts of phosphorus and potassium fertilizers and half the nitrogen rate are regularly applied during pre-sowing cultivation of soil. The trial was set up in a randomized block design with five replications. The crop was harvested at full maturity. Grain yield (t/ha) was harvested and reported at 14% moisture. Three parameters were analyzed: test weight (kg/hl), 1000-grain weight (g) and grain yield (t/ha).

Investigation where showed a considerable variation of grain yield which were in dependence from mineral nutrition. The highest grain yields were the highest with mineral fertilizer in the combined 80 kg/ha N, 100 kg/ha P₂O₅ and 60 kg/ha K₂O (4.738 t/ha). Over the two-year period, all investigated treatments of wheat achieved the highest average 1000-grain weight in the combined 80 kg/ha N and 60 kg/ha P₂O₅ (43.08 g). The highest test weight were the highest with mineral fertilizer in the combined 80 kg/ha N, 60 kg/ha P₂O₅ and 60 kg/ha K₂O (73.63 kg/hl). Analysis of variance was found highly significant effect of years on 1000 grains weight. Different combinations of fertilization had the most highly significant influence on all characters. Significantly positively and strong correlated with yield and 1000 grain weight both in 2011/12 (0.75**, respectively), and 2012/13 (0.81**, respectively). Mineral fertilizers play a vital role towards improving crop yields but one of the main constraints in achieving proven crop potential is imbalanced use of nutrients, particularly low use of P as compared to N. The optimum rate of P application is important in improving yields of most crops. In Serbia, farmers are using only nitrogen fertilizers for fodder crops while the use of P fertilizer is negligible (Đekić et al., 2014; Jelić et al., 2013, 2014). The absence of record yields indicates that an answer could be sought in soil, the main substrate for field crop production. Environmental conditions (weather and soil) and fertilization have a significant effect on grain yield and quality in wheat (Popović, 2010; Đekić et al., 2013; 2015; Jelic et al., 2015; Terzić et al., 2018). Grain yield shows a tendency to increase in the years having a higher total amount and better distribution of rainfall during critical plant development stages.

Keywords: fertilization, yield, quality, wheat

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Particularities of propagation of the *Lonicera caerulea* through the cultivation *in vitro*

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Abstract

Cultivation *in vitro* is an alternative method of plant reproduction and preserving of plant resources. We have studied 14 varieties of *Lonicera caerulea* and found out the particularities of *in vitro* cultivation of this plant. As an initial material, we used sprouts 2-3 centimeters long that have one or two internodes which we obtained by the activation of meristems in the laboratory conditions. The sterilization was carried out due to the scheme: 70%-ethanol (60 c) → 0,1 % HgCl₂ (7 min) → distilled water (three times, each 10 min). The influence of growth regulators of auxin, cytokinin, and hybberellin effect on a regeneration of microsprouts from vegetative buds of honeysuckle was studied. The range of agar nutrient media Murashige and Skoog (MS), Halupy, and DKW which we have modified was tested. The grows regulators and aminoacids, such as glycine and glutamine, were added to the nutrient media. For all of the varieties of plants, the highest activation of axillary meristems was observed for the cultures on the MS-nutrient medium with addition of 6-BAP, 4 mg/L. We have established that the most of initial tissues are formed on the DKW medium with the addition of 4 mg/L of 6-BAP and DKW with the addition of 1 mg/L of GA₃. The active process of rhizogenesis of newly formed sprouts of honeysuckle was observed on the MS-medium with half of the concentrations of micro- and macronutrients, vitamins, and IBA in concentration of 1 mg/L. The average length of roots was 2 – 3 centimeters. The rooted sprouts were planted on the soil with the high humidity. The part of survived regenerated plants was 93-95%, depending on the variety of the plant.

Key words: *Lonicera caerulea*, explant, nutrient medium, growth regulators, rhisogenesis.

Pomological, quality and organoleptic traits of some autochthonous apple varieties in Prespa region

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Abstract

In the Prespa region, apples have been grown for centuries. In that long period different varieties have been dominantly grown. At the first half of the twentieth century, a large number of newly created varieties were introduced, replacing the old varieties. However, much of the then existing varieties planted in yards, swords, or abandoned plantations were not destroyed, resulting in their preservation until today. Lately, biodiversity preservation is becoming more important. These varieties in their code possess genes that determine highly prized properties in apples. All these characteristics of autochthonous varieties impose the need for their detailed study, conservation and limited growing. Inventory of autochthonous varieties of apples that have long been present in the production of apple in the Prespa region was made in the period 2006-2008. Seedlings grafted on MM106 rootstock were produced from the inventory varieties and they were planted in 2013. The paper presents the morphometrically, pomological, quality and organoleptic properties of the following 13 autochthonous varieties of apples: Tetovka, Avavija, Zvecarka, Kojce, Crveno blago, Pashinka, Karapasha, Sareno blago, Alamanka, Kolačara, Ciganka, Pariska palma and Srchika. All investigated varieties possess an interesting features. Based of overall results some of them deserve to be grown in traditional orchards in typical rural areas without use of chemicals and in environmental protection programs. Many of these varieties in their code possess genes that determine significant quality properties of apples and that's why these variety are important for breeders as a source of genes in some breeding programs. Many of these varieties today do not have greater economic and agronomic value, yet some of this indigenous gene pool has great socio-cultural significance and should be preserve in situ collections.

Keywords: *Malus x domestica*, indigenous, biodiversity, characteristics, preservation

***In vitro* induction of multiple shoots in *Zamioculcas zamiifolia* Engl.**

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Abstract

Zamioculcas zamiifolia Engl. (ZZ), is an indoor ornamental plant native of Eastern Africa. This stem-less herbaceous monocot belonging to family Araceae, produces attractive dark green and glossy foliage with succulent rhizomes at the base. The plant has gained popularity internationally, as it can adopt to reduced light and water stressed conditions. The plants are propagated vegetatively using leaflets. Large scale multiplication is very expensive due to its slow growth and low multiplication rate under *in vivo* conditions. Micropropagation studies on *Z. zamiifolia* were carried out to induce multiple shoots *in vitro* using explants of leaf, petiole and rachis sections. The explants were cultured on Murashige and Skoog medium with 30 g L⁻¹ sucrose, supplemented with BA at 4.44 µM to 13.32 µM and kinetin at 4.64 µM to 13.94 µM in combination with NAA at 0.53 µM to 1.61 µM and IBA at 0.49 µM to 1.47 µM and TDZ at 2.5 µM to 10.0 µM. Indirect morphogenic response was observed from all explants. Petiole sections showed better response compared to leaf and rachis sections. Callus intensity was highest in the medium supplemented with 4.64 µM kinetin + 1.61 µM NAA at 30 days. More rhizomes were recorded in the medium supplemented with 2.5 µM of TDZ at 90 days. Maximum number of globular like structures (GLS) were noticed in the medium supplemented with 10 µM of TDZ after 75 days. Number of roots and root length was better in the medium supplemented with 13.32 µM BA + 1.61 µM NAA at 75 days and 180 days respectively. Number of shoots and shoot length was highest in the presence of 9.29 µM kinetin + 1.61 µM NAA at 150 days and 180 days respectively.

Key words: *Zamioculcas zamiifolia*, Growth regulators, Callus, Rhizome, Multiple shoots

Assessment of influence of temperature regimes on seed germination in Bird of Paradise (*Strelitzia reginae*)

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Abstract

The present research work on effect of temperature on germination of Bird of paradise (*Strelitzia reginae*) seeds was carried out at ICAR-Indian Institute of Horticultural Research, Bengaluru, India during 2016-17. In this study, we exposed mature seeds of Bird of Paradise to five different temperatures under laboratory conditions with four replications. The treatments included alternate temperatures of 20°C /30°C for 16/8 hrs, constant temperature of 30°C for 24 hrs, constant temperature of 35°C for 24 hrs, alternate temperatures of 25°C /35°C for 16/8 hrs and control (room temperature-25±2°C). Temperature affected germination rate and final germination percentage. Days taken for first germination were significantly different among the various temperatures. Number of days taken for first germination ranged from 16 to 20 days. The first sign of germination was observed in T₄ (25°C/35°C for 16/8 hrs) at 16 days, whereas, no sign of germination was observed in T₃ (Constant 35°C for 24 hrs). Mean germination percentage (75.03%) was maximum at 20°C /30°C -16/8 hrs and was poor at constant 35°C for 24 hrs. The bird of paradise seeds require a particular temperature to initiate germination and temperature regimes vary from species to species. Maximum Plant height (8.2 cm) at 3 months after sowing was recorded in T₄ (25°C/35°C for 16/8 hrs) in Net house conditions (Temperature 23° to 30° C and RH 70 to 80%). Highest plant girth (2.80 cm) at 3 months after sowing was recorded in T₄ (25°C/35°C for 16/8 hrs) and followed by 2.65cm (Constant 30°C/24hrs). The results showed that T₄ (25°C/35°C for 16/8 hrs) was most suitable temperature regime not only to get maximum germination but also to obtain more vigorous seedlings with respect to seedling growth parameters.

Key words: Bird of Paradise, *Strelitzia reginae*, temperature regimes, germination, growth parameters

***In vitro* micropropagation of Potato (*Solanum tuberosum* L.) cultivars**

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Abstract

In vitro micro propagation is an alternative to conventional (vegetative) propagation of potatoes whereas aseptically meristem cultures were used which gave pathogen free plants. Different sterilization protocols were used for disinfecting the isolates potato sprouts from two potato genotypes named Excuisita and Bergerac. After 35-40 days of culture shoot height, number of shoots per explants, and number of roots were measured. It was found that the suitable sterilization protocol giving high percentages of survived individuals was that of 1% HgCl₂. The sterilized sprouts were cut to isolate apical meristems which were cultured on shoot induction medium containing solidified MS media with vitamins and exogenous plant growth regulators and incubated at optimized culture conditions in room culture. The cultivar Bergerac showed greater ability for *in vitro* propagation with 6.3 shoots per explants but Excuisita plantlets presented higher shoot length (72.5 mm). The aim of the study was the presentation of suitable protocol for *in vitro* induction of potato plantlets stocks free of pathogens.

Background: The main goal of this research was to set up a culture of meristem tips cultures as initial explants of two potato cultivars Excuisita and Bergerac in *in vitro* conditions. Explants development, organogenesis stage of explants on MS media supplemented with growth regulators and possibilities for minituber production from potatoes plants were followed during this experimental work;

Methods: The experiment was conducted at the Institute of Plant Genetic Resources, (Agriculture University of Tirana). Potato cultivars Excuisita and Bergerac were used as plant material for evaluation on their response to *in vitro* regeneration. The initial explants were cultured in Murashige and Skoog (Murashige and Skoog 1962) solid medium (pH=5.8) in test tubes supplemented with plant hormone. MS media was prepared with 3% sucrose, 0.6% agar, 2ppm Ca pantothenic acid and 0.25ppm GA₃;

Results: All treated tubers resulted with *de novo* sprout, which shows effect of 100% in sprouts formation. A higher number of sprouts are formed from the cultivar Excuisita with an average of 8.21 sprouts per tuber. Results show that between two chemical solutions HgCl₂ was found more effective than NaOCl. All the explants of two potato cultivars of our study, treated with sodium hypochlorite solution, resulted infected (100%). While mercuric solution gave positive results in Excuisita and Bergerac explants with a high survival rate of 57%. Excuisita explants gave 96.34% of germination on agar media 0.6% and Bergerac cultivar 85.5%. The results show that cultivar Excuisita has maximum potential for creating new plantlets with higher values on shoot height (± 72.2 mm) and leaf number in compare of Bergerac cultivar (± 54.76 mm). We achieved the formation of minitubers with an average weight of 10-12 g from Excuisita plants.; and **Conclusions:** The multiplication rate of two potatoes cultivars, object of the study, was highly effective on producing a satisfactory number of explants on MS media. The combination of GA₃ with BAP was effective in improving the explants development, organogenesis stage and possibilities for minituber

production from potatoes plants during this experimental work. The technique used in our study might be a possible one, for cloning of other potatoes cultivar plants.

Keywords: *In vitro*; meristem cultures; cultivar; MS media; shoot length

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Content of natural pigments in fruit seeds

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Abstract

Natural pigments are coloured, complex organic compounds whose optical properties are based on the chemical structure of their molecules. Natural pigments are attributed, inter alia, to the antioxidant role in the organism, which is why they are the subject of numerous pharmacological tests

Material

Samples of strawberries, raspberries and blueberries purchased in the markets in Triesdorf (Germany) and samples of the same fruit species from the localities in the northern part of Montenegro (Bijelo Polje) were taken for the analysis.

Technique

By standard method - by drying the sample, to which is added 96% Ethanol, then poured into the tubes and centrifuged for 5 min, then the sample is poured into the cuvettes and read on the spectrophotometer and the values obtained are calculated according to the formulas.

$$c \text{ Chl } a = 11,75 \times E662 - 2,35 \times E645$$

$$c \text{ Chl } b = 18,61 \times E645 - 3,96 \times E662$$

$$c \text{ Car} = \frac{1000 \times E470 - 2,27 \times c \text{ Chl } a - 81,4 \times c \text{ Chl } b}{227}$$

Results

The average content of chlorophyll, in strawberry fruit, taken in the markets in Germany, was 11.0680 mg / 100gr of dry fruits, while the content of chlorophyll b ranged from 14.7331 to 21.1554 mg. The average content of Carotenoid was 6.9371 mg, while the range of Carotenoids ranged from 4.2516 to 10. 0191 mg. The content of chlorophyll in strawberry fruit (Montenegro) ranged from 4.2650 to 22.2125 mg / 100gr. The average content of Chlorophyll b was 26.5306 mg, and Carotenoid 12.4219

The content of chlorophyll b in blueberry fruits purchased in the markets of Triesdorf (Germany) ranged from 12.925 to 25.5445, chlorophyll b ranging from 19.6983 to 73.0382, and carotenoid 13.6110-47.7602 mg / 100gr. In the blueberry fruits (Montenegro), the average chlorophyll content was 20.8406 mg / 100g of dry sample, chlorophyll b 51.3287mg and carotenoid 45.9456mg / 100g sample.

The average content of chlorophyll and in the fruits of raspberry originating from the German market was 5.1582 mg / 100 g of dry matter, chlorophyll b 15.8902 mg, and carotenoid 45.4400 mg. The average content of chlorophyll was 22.8112mg, chlorophyll b 42.1225 mg and carotenoid 31. 3300 mg / 100g dry sample in fruits from Montenegro.

Conclusion

Differences in the content of colored substances in the fruits of the tested fruit are due to differences in the genotypic value and the deviation of the condition of the superior environmental conditions

The work was created as a result of the cooperation of the two Universities in the Erasmus program

Importance of crop rotation for increasing of biomass and yield of maize

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Abstract

Crop rotation has many positive effects on plant production and one of them can be increasing of growing parameters (height, leaf area and grain yield). The trial was set up on experimental field of Maize Research Institute “Zemun Polje” and conducted from 2009-2012. In our experiment we compared maize monoculture (MM) and three crop rotation maize-soyabean-wheat-maize (MSWM). We used two hybrids of maize and one of them was ZP 677 (elder hybrid) and second was ZP 606 (newer hybrid). Parameters which we measured were height of plant (cm), leaf area (LAI index m²/m²) and grain yield (kg/ha) of maize. After four years of experiment (2012 year), when finished first cycle in crop rotation, we got much better results in crop rotation compared to maize monoculture in both hybrids. ZP 677 had higher LAI index and higher plants when we cultivate in crop rotation than in maize monoculture. In ZP 606 results were much better, so we had higher LAI index, higher plants and 1,5 t/ha higher grain yield in crop rotation in comparison with maize monoculture. If we had more rain in 2012 year (extremely dry year) difference in grain yield could be higher. So we can conclude that maize must be cultivating in crop rotation especially newer hybrids.

Key words: Crop rotation, grain yield, hybrid.

The production of carbonated juices in Montenegro

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Abstract

The paper presents the results of testing the production of carbonated juices Orange and Cola in Fabrika "Fru Monte" near Danilovgrad in the period 2017-18. where the carbonated water is added to the prepared syrup in a precisely determined relationship, as well as by the preparation of a mixture of sugar syrup and a base with a certain percentage of dry matter which is then added to carbon dioxide in a particular ratio.

Production is carried out according to the most modern method and production technology with the application of the highest standards ISO 9001: 2008 and HACCP system.

The energy value of carbonated juices, in particular Orange and Cole, ranges from 163 to 463 kJ per 250 ml of juice. The fat and protein contents range below 0.1 g. The amount of carbohydrates ranges from 9.6 in Orange to 10.9 in Cole.

In addition to the above-mentioned basic ingredients, Orange and Cola also contain some side-by-side, only certain substances for them, namely, preservatives and additives.

Juice Factory "Fru Monte" is the only factory in Montenegro for packing carbonated juices in PET packaging (packaging of 2 l), because it allows for longer keeping, fresh smell and taste, as well as retaining organoleptic characteristics properties.

Key words: carbonated juices, production process, energy value, fats, proteins, carbohydrates

Breeding and safe cultivation of wheat

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Abstract

Wheat breeding provided new insight to improvement of yield, quality of genotypes in different environments. The yield and quality can improve through optimizing application of scientific farming measure in crops, as well increasing fertilizer use efficiency and water use efficiency [1]. The practices measure, irrigation and nitrogen fertilizer input are significant cost factor and potential environmental pollutant [2]. Also, climate variation is additional factor that makes it difficult for farmers to optimize the technology of growing of wheat [3]. The aim of this work is to develop new approach in successful breeding and production of wheat. In this work studied data of breeding and technology growing in increasing of yield and quality of wheat. The study of numerous investigation showed that yield potential depends from genetic and environmental factor as well from genotype by environment interaction (nutrients, water regime, climate factors, pests, diseases, weeds) [4]. The identification of genes that controls morpho-physiological, biochemical, productive, technological and quality traits effected on developing new gene concept of wheat breeding (*Rht*, *Ppd*, *Vrn*, *Gli-1*, *Gli-2*, *Glu-1*, *Glu-3*, etc.) and creation semi dwarf varieties with increased yield, quality, harvest index, lodging resistances, resistance to stress factor. The technology growing based on larger doses of nitrogen fertilizers and pesticides, also, has contributed to increasing yield for 3-4 times and nowadays wheat world production more than 710 million metric tons [5]. For improvement in wheat breeding and production requires an innovative interdisciplinary approach of monitoring and prediction of wheat crop response to environmental factors by using information technology, biotechnology, agrometeorology, genetic methods [6]. Future efficient breeding progress in wheat under targeted environments and interdisciplinary approach in development of forecasting of wheat model production will come from the integrated knowledge of physiology, genomics, programing and farm management.

Keywords: wheat; breeding; information technology; forecasting; production.

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Seed mineral reserves of Bambara groundnut (*Vigna subterranea* L.) differing in seed coat colour: seed vigour rapid evaluation

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Abstract

A newly germinated seedling, given light and water but no external source of minerals, use its internal mineral nutrient reserves effectively for an early establishment. This research sought to investigate the influence of phenotypic trait (seed coat colour) on the abundance of mineral elements in Bambara groundnut landraces. Four landraces from the soil of same nutritional history were analyzed for differences in seed mineral composition using energy dispersive x-ray (EDX) analysis and atomic absorption spectrometry (AAS). Seed vigour for the landraces was evaluated by the cold test, seeds were germinated at two temperatures (10 °C and 25 °C) and calculation of germination indices, (1) mean emergence time (MET), (2) mean germination rate (MGR), (3) coefficient of velocity of germination (CVG) and (4) final germination percentage (FGP) was done. We examined the importance of seed mineral elements in the early establishment of Bambara groundnut restricted to nutrient-impooverished sand soil by measuring changes in root length (RL), shoot length (SL), shoot dry mass (SDM) and root dry mass (RDM) at 14 and 21 days after sowing (DAS). Plant tissue (shoots and cotyledons) elemental analysis was done using flame atomic emission spectrometry (FAES) for K and flame atomic absorption spectrometry (FAAS) for Mg, Cu, Mn, Fe and Zn. There were significant differences ($P < 0.001$) in mineral element content of dry seeds, G340A and Kazai had highest and lowest K, P, Mg, Mn and Zn (11.65 gkg^{-1} , 7.2 gkg^{-1} , 2.33 gkg^{-1} , 59.56 mgkg^{-1} and 44.42 mgkg^{-1}) and (8.82 gkg^{-1} , 4.75 gkg^{-1} , 1.38 gkg^{-1} , 48.9 mgkg^{-1} and 42.6 mgkg^{-1}) respectively. Cold test germination indices were significantly different, the highest FGP was 73.3% in G340A and lowest was 57.8% in Kazai. There were strong positive correlations between seed mineral concentration and plant growth parameters. The study concluded that (1) seed mineral concentration has a significant impact on the early establishment of Bambara groundnut and (2) dark-coloured landraces used in this study have the high concentration of macro and micro elements compared to light coloured seeds.

Keywords: Seed mineral, Spectrometry, Bambara groundnut

Influence of meteorological parameters on the Yield and Chemical composition of Common buckwheat (*Fagopyrum esculentum* Moench)

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Abstract

Common buckwheat (*Fagopyrum esculentum* Moench) is an annual plant from Polygonaceae family which is well known as pseudocereals with high nutritional value. The yield and quality of the buckwheat's kernel depend on weather conditions in some years, mainly due to variations in the air temperatures and precipitation during the growing period. The aim of this study was to determine the impact of some metrological parameters on yields and chemical composition in the kernel of buckwheat. Field experiments were conducted during three years (2011, 2012 and 2013) in the village Donje Selo, near Ilijaš. In this study grain yield, protein content, sludge, fats, mineral matter, cellulose and total phenols were determined. Experimental results suggested that the weather conditions in different years of the research have had a significant impact on the yield and the chemical composition of the kernel. The yield of buckwheat varied from the year to year and ranged from 0.7 to 1.32 tons per hectare. Contents of protein and starch were also significantly dependent on the year of the research, as well as the content of phenol in the kernel. High total phenolic content was recorded in the year with the highest average monthly air temperature.

Keywords: meteorological parameters, yield, chemical composition, buckwheat

Comparison of Spectral Classification Techniques in Determining the Amount of Fertilizer in Sugar Beet

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Abstract

Agricultural applications have been one of the areas where remote sensing and its terrestrial components are frequently used with the development of technology. Plant production, forestry, food safety and management of agricultural policies could be achieved by using remote sensing and its terrestrial components. Determination of the amount of fertilizer treated to plants could also be achieved by remote sensing methods. In this context, phosphorus fertilization was treated to sugar beet plants in this study. Phosphorus fertilizer is very important for the development of plants, but overdose can damage both the plant and the ecosystem. Therefore, it is important to apply the correct amount of phosphorus fertilization, also it could be followed by remote sensing. This study was carried out in a field and sugar beets were treated to 3 different phosphorus fertilization which are 0 kg P ha⁻¹, 150 kg P ha⁻¹ and 300 kg P ha⁻¹. After the growing of sugar beets, spectroradiometer measurements were made to measure the reflectance responses of the plants to different phosphorus doses. Then, the reflectance obtained with the spectroradiometer were resampled to the Sentinel 2 satellite band ranges for use as end members in the spectral classification. As spectral classification methods, matched filtering and spectral angle mapper algorithms were used in order to classify sugar beets which are different amount of fertilization. As a result of the applied spectral classification algorithms, the determination of sugar beets having different amounts of fertilizer could be made. In addition, it was understood which classification algorithm gave better results.

Keywords: sugar beet; spectral classification; phosphorus; matched filtering; spectral angle mapper

Apple Tree – Biological peculiarities, Need for Irrigation and Water Saving Irrigation Technologies

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Abstract

The paper presents an overview on the biological requirements, the abiotic stressing factors in our geographic region, the need in irrigation and the irrigation technologies in apple tree growing. The yields obtained by different researchers in different parts of the world are cited, as well as the factors and agricultural practices oriented to increasing them. The paper examines the sensibility of apple to water and the effect of water deficit on the yield. Some results of the yearly and monthly evapotranspiration of apple are discussed, as well as the crop coefficients from different empirical methods for calculation of the evapotranspiration. An irrigation scheduling at drip irrigation technology is well motivated. The conclusions show that the soil and climatic conditions in Bulgaria are suitable for growing apple trees, irrigation is inevitably needed and contributes to obtaining sustainable yields. It is stated that water harvesting mulching technology is most efficient for gaining high water use efficiency and high yields.

Keywords: apple tree; good practices; yields; water harvesting; mulching

Effects of irrigation on production and quality of dill, marigold and basil in different weather conditions

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Abstract

The application of irrigation soil is regulated and improved its water regime, where by improving production traits and growing conditions of plants which are produced on them, because of that, and for mitigation increasing and more frequent oscillations of weather conditions during the production years. The trial was conducted in irrigation medicinal, aromatic and spice herbs, whose representatives: dill, basil and marigold. The experiment was conducted on plots Institute of Field and Vegetable Crops, in Bački Petrovac, central Vojvodina, during rainy 2016 and drought, 2017, in two variants: 1. control, without irrigation and 2. variant with irrigation drop by drop. The amount of added water or irrigation norm was determined by monitoring soil water balance, and amounted to 120 mm four watering 2016 and 300 mm in 10 watering drought in 2017. The effect of irrigation on yield it was noticed in both years, rainy 2016 from 8.36% in basil to 47.41% in dill and dry 2017, 78.59% at dill to 105.46% at marigold. In the conditions of irrigation, in both years of production, increased with yields of green mass and yields of essential oils and carotenoids, as the main indicators quality cultivated crops. Environmental conditions (weather and soil) have a significant effect on grain yield and quality in sweet basil (Pejić et al., 2017) and dill (Maksimović et al., 2018). Grain shows a tendency to increase in the years having a higher total amount and better distribution of rainfall during critical plant development stages. Irrigation in these phases is a crucial factor for the successful production of dill, marigold and basil.

Key words: irrigation, yield, essential oils and carotenoids, dill, marigold, basil.

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Effect of quantity of nitrogen on maize yield

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Abstract

Maize is the leading farm cultures in the world. The primary aim of maize production is to gain high and steady incomes. Varying of the incomes of the grown plants is seen in a great measure both as a consequence of weather conditions and applied quantities of nitrogen fertilizer. In this work, in a two-year period, on the locality of Eastern Srem (88 altitude), it is examined how the increasing quantities of nitrogen fertilizer influence of the productivity parameters, that is, morphological features and components of the incomes of Serbian maize hybrid. During vegetation period optimal cultivation technology was applied (Šarčević-Todosijević et al., 2016). The examinations covered the following systems of maize fertilization: control (without fertilizer), P₉₀K₆₀N₃₀ kg ha⁻¹ (basic, phon), P₉₀K₆₀N₆₀ kg ha⁻¹, P₉₀K₆₀N₁₂₀ kg ha⁻¹, P₉₀K₆₀N₁₈₀ kg ha⁻¹. Within the morphological features of maize, it is examined the influence of the nitrogen fertilizer on the growth of a plant and the number of leaves on a maizecob, and within the components of the income, its influence on the length of a cob, the number of grain rows and the number of grains on a cob. The results of our research have shown that, on the average for the examined factors, the height of a plant was 276.1 cm. On the average for the years, along with the increasing quantities of nitrogen up to 120 kg ha⁻¹, the height of a plant increased, and then it declined. The differences in the height of a plant between treatments were statistically significant and very significant. The number of leaves on a stalk, on the two-year average was 14.0. On the average for the years, along with the increase of nitrogen quantities up to 120 kg ha⁻¹, the number of leaves increased, and then it declined. Statistically significant differences were got between controls and quantities of 60 and 120 kg ha⁻¹ N, as well as of phon and 120 kg ha⁻¹ of nitrogen. Approximately for the examined factors, the length of the corn cob was 20.0 cm. On the average for the years, while the quantities of nitrogen up to 120 kg ha⁻¹ increased, the length of a cob grew, and then it stagnated. The shortest length of a cob (18.8 cm) belonged to the controlled plants, and the longest ones (20.6 cm) were those of the plants with the applied of 120 kg ha⁻¹ N. The differences between treatments were statistically very significant. On the average, for the covered factors, the number of grain rows on the cob was 15.2. Between the years of the examinations, some significant difference in the number of grain rows on the cob was not noticed. On the other hand, nitrogen manifested a completely specific influence on this parameter of maize fertility. On the average, within one-year period, with the increase of nitrogen quantity up to 120 kg ha⁻¹, the number of the grain rows increased, and then it stagnated. The differences between treatments were significant and very significant. The number of grains was, on the average for the examined factors, 636.6. In the first year of the research, the number of grains on a cob was slightly higher than in its second year, but that difference was not justified. Opposite to that, additional nutrition with nitrogen manifested its influence on this component of the income. On the average for the years, along with the increase of nitrogen quantity up to 120 kg ha⁻¹, the number of grains on a cob also increased, and then it mildly stagnated. According to the conducted research, it can be concluded that on the soil of "cernozem" type and in the climate conditions of E. Srem, a proper nitrogen nutrition applied on the examined hybrid, implies the use of 120 kg ha⁻¹ N, on a fon 90 kg ha⁻¹ of phosphorus and 60 kg ha⁻¹ of potassium.

Key words: fertilizer, maize productivity, climate conditions.

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The distribution and quality of wild pomegranate in the Mediterranean region of Montenegro

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Abstract

Pomegranate is a low tree or bush 3 to 5 meters high. By vegetation, it is deciduous or semi-deciduous. The origin of the pomegranate is the area between the Persian Gulf and the Caspian Sea (Iran), from where it spread first through the Mediterranean, and then to other subtropical regions around the world. Everywhere in Montenegro, where there is affect of Adriatic climate, and the absolute minima are not lower than -15 C, the wild pomegrante is spread. He grows like a shrub or a bush across the rugged and poor soil. Except a self- soun (known as wild pomegranate) in the Mediterranean part of Montenegro, there is a widespread of cultivated pomegranate. The fruit of a cultivated pomegranate is similar to a wild, only smaller dimensions. Cultivated varieties fruit has an average of 300 to 400 grams, and fruit of wild of 50 to 250 grams. Its bark is hard and leathery, yellow-green to dark, rarely red. Inside there are diaphragms or lamellas, among which are juicy reddish grains with white seeds in the middle. The fruit of wild pomegranate is mostly used to produce high-quality juice, although bark can also be used in the food and pharmaceutical industry. Research on the distribution of wild pomegranate in the Mediterranean part of Montenegro started in 2017, and officially in 2018, after the acceptance of the project: *Individual selection of wild pomegrante from a heterogeneous natural population*, which is approved and financed by the Ministry of Science of Montenegro. The first field research has shown that wild pomegranate is quite widespread in Montenegro, although for the last twenty years only part of the harvest has been done, and processed into juice, because there is no organized buy-out. However, the world literature in the last ten years has convincingly demonstrated that the quality of the fruit of this self-soun plant is remarkable, and interest in it, or for its juice, growing rapidly. Research on the quality of wild pomegranate juice from the Mediterranean part of Montenegro was carried out only in 1956 and 1957, at the Faculty of Agriculture in Zemun. These studies have shown that freshly sifted wild pomegrante juice has 18.9% dry matter, 12.3% total (as invert) sugar, 3.9% of total acids, 0.7% tannic matter, 0.1% pectin substances and 14.2 mg% vitamin C. Wild pomegrante has approximately equal sugar % as well as cultivated, but due to considerably more acidity, has strong acid taste. The ratio of sugar and acidity to the sweet (cultivated) is 29: 1, and in acidic (wild) 3: 1. The fruits for these analyzes were picked from the area between Rijeka Crnojević and Podgorica. The first field examinations showed that the wild pomegranate is widely represented in the following municipalities: Ulcinj, Bar, Budva, Tivat, Kotor, Herceg Novi, Podgorica, Danilovgrad, less in the municipality of Cetinje, and sporadically in the Nikšić municipality. According to a rough estimate, 60% of the area under the wild pomegrante is located in the continental part, and 40% in the coastal part of Montenegro. On approximate area of 500 ha, there are slightly over 400,000 wild pomegranate bushes. Almost half of the bushes are located in the municipalities of Podgorica and Danilovgrad. More detailed examinations of distribution in these two municipalities will cover all places (villages) where the wild pomegrante is located in larger groups. Fruit quality tests from isolated individuals will be carried out at the beginning of 2019. This work aims to answer the question of where the wild pomegranate is widespread in our country, in order to better organize his harvest, and also to extract the best individuals from the field, to multiply them and to raise plantations, and all this in order to increase the raw material base for the production of wild pomegranate juice.

Key words: Pomegranate, Mediterranean region, Montenegro

The impact of weather and soil conditions on biomass productivity and essential oil of coastal immortelle

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Abstract:

Immortelle (*Helichrysum arenarium*) It's a representative of the family headache (Asteraceae), genus *Helichrysum*. *Helichrysum* genus consists of about 600 species widespread throughout the world, especially in South Africa and in the Mediterranean area. The volatile constituents, particularly monoterpenes, depended by the plant's genotype and ecological adaptation. Immortelle starts to blossom in May and ends up in September. Pollination is by insects, so that the immortelle belongs to honey plants (Giovannelli et al., 2018; Miloradović et al., 2018).

In this paper he was studied the influence of agro-ecological factors on productivity coastal immortelle at two locality, flatland area of the Banat and mountainous region of the central Pomoravlje. Seedlings immortelle is sown in greenhouse at the end of December 2015, and the plants are re-planted on experimental fields in April 2016. He was examined the yield of dry herb immortelle and the content and yield of essential oil at both localities. Results, processed mathematical-statistical methods, they showed significant variations which are conditioned by variable ones weather conditions during 2016. This year was at a disadvantage distribution of rainfall and lower mean monthly temperatures during the winter, and in the vegetation period higher than the average for these areas. The yield of dry herb per plant, on average for both sites was 44.1 grams, with a variation of 42.8 g (Lešje) to 45.3 g (Kačarevo). The share of dry herb in total yield was 43.74%. Variation in yield by location have not shown statistically significant variation. In Kačarevo it was obtained by 5.8% more dry herbs per plant compared to the Lešje locality. Essential oil content in the dry herbs, was significantly higher in the plants from the Lešje locality, but higher yield per hectare was obtained in Kačarevo as a result of a higher yield of herb per unit area.

Keywords: coastal immortelle (*Helichrysum italicum* (Roth) G. Don), weather conditions, soil conditions.

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The influence of microbial inoculums on the quality properties of rocket (*Eruca sativa* Mill.)

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Abstract

The application of pure cultures microorganisms and the procedure of inoculation in agricultural production is a substitute for many agrochemicals used in conventional agricultural production. The aim of this research was to monitor the influence of microbial inoculums from two products with the commercial names *uniker* and *slavol s* and the isolate of the bacteria *Azotobacter sp.* applied in various ways on some quality properties of rocket. The research was carried out in rocket grown in protected space. The experiment included four variants, each variant in 3 repetitions in random block system. The variants of the experiment were: variant 1 control – untreated variant; variant 2 – treated with application of inoculum from the product *uniker* into the soil before the sowing of the rocket; variant 3 – treated with application of inoculum from two different products *uniker* and *slavol s* before sowing of the seeds, whereby *slavol s* was applied by immersion of the seeds for five minutes before sowing, and *uniker* was applied in the soil before the sowing of the rocket; variant 4 – treated with foliar application of life cells of bacteria *Azotobacter* (10^{-6} cfu/ml) every fifteen days during vegetation. The leaves of variant 3 are characterized with the highest values for the magnesium content (0.37%). For the leaves of variant 4, the highest values were obtained for the content of: organic matter (78.25%), total water (8.30%), nitrogen (3.90%), phosphorus (1.15%), potassium (2, 69%), calcium (1.40%), iron (0.0052%) and protein (24.37%). In the variant 4 there is statistically significant difference ($p < 0.05$) compared to the control variant for the calcium and iron contents, while from the aspect of magnesium content, statistically significant difference ($p < 0.05$) was obtained in variant 3 compared to the control variant.

Keywords: microbial inoculums, quality properties, rocket.

Effect of nutrition on biomass production of Lacy phacelia in organic cropping system

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Abstract

Phacelia tanacetifolia Benth., is a annual herb, has a flowering period lasting from 6 to 8 weeks, and which is listed in the top 20 pollen producing flowers for honeybees. Lacy phacelia is highly attractive to pollinator insects. It provides a source of high quality nectar and pollen. Lacy phacelia produces relatively abundant biomass. Protein content ranges from 6.7% to 19.8% at the pre-bloom stage (Popović et al., 2017). Phacelia are suitable for the remediation of soils contaminated with heavy metals. Green manure plants absorb nitrogen from the soil, preventing its leaching out of the soil (Foucault et al., 2013). The experiment with phacelia cultivar NS Piora was conducted during 2018 on experimental plots of the Institute of Field and Vegetable Crops, location in B. Petrovac, in two variants: control, without nutrition and variant with nutrition. Foliar fertilization was applied with Phyto grass & clover preparation, by Phyto complex, two times during the intensive growth of the plants. Phyto grass nutrition is a cocktail with micro and macro elements and N (1%), P₂O₅ (0.5%), K₂O (0.05%), S (0.1%), La (0.2 mg kg⁻¹), vitamins, etc. The trial was set up in a randomized block design with three replications. Phacelia was harvested at full maturity. Six parameters were analyzed: biomass yield (t/ha), plant height (cm), length of the leaf (cm), mass of inflorescence (g), length of root (cm) and grain yield per plant (g).

Foliar nutrition had a positive effect on all the tested characteristics. Analysis of variance was found highly significant effect of nutrition on leaf length and yield of biomass. The highest biomass yields were in the variant with nutrition. The yield of green biomass and plant height was higher in a variant with nutrition than the control by 8.9% and 22.18%. Plant height ranged from 70.66 cm in control, up to 86.33 cm in a variant with foliar nutrition. Grain yield per plant ranged from 0.71 g in control, up to 0.96 g in a variant with foliar nutrition. The yield of biomass has a significant positive correlation with grain yield per plant ($r=0.77^*$), length of leaf ($r=0.73^*$), plant height ($r=0.66^*$), mass of inflorescence ($r=0.56^*$), and a higher significant positive correlation with length of root ($r=0.83^{**}$). Foliar nutrition has shown a significant effect on the production of phacelia in organic cropping system.

Keywords: *Phacelia tanacetifolia*, nutrition, production, organic cropping system

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Effects of foliar nutrition on production biomass of broomcorn millet (*Panicum miliaceum* L.)

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Abstract

Vast quantities of agricultural and agro-industrial residues that are generated as a result of diverse agricultural process, represent one of the most important energy rich resources. Accumulation of this biomass, in large quantities, results in a huge loss of valuable nutritional materials as potentially useful for man and animals. Biomass contributes about twenty five percent of the world energy requirement equivalents to twenty million barrels of fuels of oil per day. It is currently the economic force of Brazil and United States where biomass contributes in three percent of their total energy resources (Bassaria, 2003). Millet can be used as a quick growing catch crop planted into corn and sorghum stubble fields. It does well plant in combination with cowpea or soybeans (Schonbeck & Morse, 2006). It has one of the lowest water requirements of any cereal (Lyon et al., 2008), and could be useful in low-input sustainable systems. Earlier summer (June) plantings produce the greatest biomass (Schonbeck & Morse, 2006). It can be terminated by mowing or disking. Winter wheat has been successfully no-till planted into millet stubble in the fall in the Great Plains (Lyon et al., 2008).

The millet cultivar Biserka used in the experiment is a cultivar developed by the Institute of Field and Vegetable Crops, from Novi Sad, Serbia. This investigation included: foliar nutrition and control without nutrition. Foliar fertilization was applied with Phyto cereals preparation, two times during the intensive growth of the plants. Phyto cereals preparation is a cocktail with micro and macro elements, vitamins, amino acids, and growth stimulants. The trial was set up in a randomized block design with three replications. The crop was harvested at full maturity. Four parameters were analyzed: plant height (cm), length of the leaf (cm), biomass yield (t/ha) and grain yield per plant (g). The cultivar Biserka, in the experiment carried out in 2018, in the experimental field of Institute of Field and Vegetable Crops, in Bački Petrovac, has achieved excellent agronomic characteristics. Stems of Biserka cultivar was light green, erect, sometimes branched at the base, and grow 0.9–1.3 m tall. Leaves alternate along the stem were covered with short hair and arching leaves may reach and over 30 cm length. Plants have shallow, fibrous root systems and produce few tillers. Cultivar Biserka has a drooping branched compact inflorescence 20–30 cm long made of many stalked, ovoid spikelet and reproduces by seeds yellow color, 2.5–3 mm long.

Analysis of variance was found highly significant effect of nutrition in all tested characters. Foliar nutrition had the most highly significant influence on plant height. Investigation where showed a considerable variation of biomass yield which was independence from foliar nutrition. The highest biomass yields were in the variant with nutrition. Plant height was statistically significantly higher in the variant with foliar nutrition compared to the control a difference of 17.67 cm was achieved or 18.73%. The yield of green biomass in a variant with nutrition was higher than the control by 8.2%. Seed yield per plant ranged from 6.52 g in control, up to 9.24 g in a variant with foliar nutrition. The yield of biomass has a significant positive correlation on plant height ($r=0.79$), length of leaf ($r=0.99$) and grain yield per plant ($r=0.93$).

Nutrition was significantly positively and strong correlated with plant height and grain yield per plant ($r=0.99$ and $r=0.92$), and significantly positively correlated with yield biomass ($r=0.74$).

Agro-ecological and agro-technical practices have a significant effect on plant productivity (Popović, 2010; Đekić et al., 2013; 2015). The small millets are valued by traditional farmers for their nutritional content and health promoting properties, ability to grow under low input conditions and tolerance to extreme environmental stress, especially drought. In a world facing limiting natural resources and climate change, these crops thus hold tremendous potential as valuable instruments in the toolkit of the New Green Revolution. It is hoped that germplasm resources combined with modern genomic tools can help to accelerate exploitation of this biodiversity (Goron & Raizada, 2015). Nutrition plays a vital role towards improving biomass yields and productivity of millet.

Keywords: millet, foliar nutrition, productivity, biomass yield, correlation

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The importance of using the Float Tray System technology in the production of tobacco seedlings

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Abstract

Background: Macedonia is characterized by a highly variable climate that has already experienced an increase in mean temperature and moisture deficits, as well as an increase in the severity of extreme events like drought, heat waves and forest fires. Regarding climate change, tobacco is one of the most stable crops where changes will not affect further production. However, more advanced production technologies should be implemented to maintain the yield and quality of oriental tobacco. Methods: Research conducted on the oriental tobacco cultivars: *prilep NS72* and *yaka YV125/3*. In order to improve the quality of tobacco seedlings, the Float Tray System (two variants of NPK fertilizers with different amounts of nutrients) has been used in this study compared to the conventional production of tobacco seedlings (control variant). Results: In terms of quality of tobacco seedlings, better results were obtained regarding the dimensions of the plant, uniformity and total weight. The results show a statistically significant difference between numbers of accepted plants after transplantation. Regarding the technology of seedlings production, there is also a statistically significant difference between the mass of the green leaf between the variants. Conclusions: To improve tobacco production is necessary to involve the implementation of new technologies for production of tobacco seedlings. FloatTraySystem represents advanced technology in the production of seedlings which is of particular importance for the improvement of the viability of tobacco plants. Allows maximum utilization of the dissolved nutrients, such plants have stronger root system, they have a strong and rapid development of the stem that will allow in extreme climatic conditions to form a corresponding number of equal leaves that will synthesize and accumulate more dry mass.

Key words: Float Tray System, tobacco seedlings, oriental tobacco

(2) Plant protection and food safety

Grasslawn armyworm *Spodoptera cilium* Guenée – first record in Montenegro

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Abstract

Spodoptera cilium (grasslawn armyworm, dark mottled willow, lawn caterpillar) belongs to lepidopteran family Noctuidae. It is found throughout Sub-Saharan Africa and western, southern and south-east Asia. It is also reported in several European countries, particularly in the south (mainland of Greece, Italy, France, Portugal, Spain), as well on some islands (Balearic, Canary, Corsica, Cyprus, Crete, Madeira, Malta, Sardinia, Sicilia). The species is a migrant to northern Europe (UK, Ukraine). It is a pest of various graminaceous plants. At high densities the foliage-feeding larvae can completely defoliate an area in a short time.

In September 2018 severe damage caused by noctuid larvae were noticed on lawn within a complex of tourist hotels in the coastal area of the city Ulcinj. The attacked lawn was almost completely dry with sporadically present green parts. During observation, scarce presence of larvae of different instars and colours was recorded. Soil samples with larvae and already formed pupae were collected, transferred to the entomology laboratory. Samples were placed in plastic boxes in laboratory conditions until adult eclosion.

According morphological features of larvae and adults the species is determined as *Spodoptera cilium*. Larvae are up to 2,5 cm long, body grey with bold ochreous dorsal and subdorsal stripes and brown head. Adults forewings are pale grayish- brown; the round spot is more-less circle-shaped, brownish beige, surrounded by straw yellow; kidney-shaped spot is blackish and darker than the general wing color. The hind wings are whitish. The slide preparation of male genitalia were also done. This finding is the first report of *S. cilium* in Montenegro.

Keywords: *Spodoptera cilium*, first record, Montenegro

***Scaphoideus titanus* Ball. - American grapevine leafhopper: Results of monitoring in 2018 in Montenegrin vineyards**

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Abstract

The Nearctic leafhopper, *Scaphoideus titanus* Ball. (Hemiptera: Cicadellidae) is the main vector of Flavescence dorée (FD) phytoplasma. It is one of the most important and damaging phytoplasma diseases of grapevine. *S. titanus* is introduced into Europe 1958 in the France, from where is gradually spread to many European countries. This is a monophagous and univoltine that overwinters as egg laid under grapevine bark. All larval stages and adults feeds on grapevine leaves and if feeding on infected plants ingest phytoplasma. *S. titanus* was detected for the first time in Montenegro in August 2008 on a yellow sticky trap in one vineyard near Podgorica. In the following years it gradually spread and was found in the most of Montenegrin viticultural regions.

Presence and seasonal dynamic of *S. titanus* was followed in 12 vineyards in 7 localities in 2018. Monitoring included visual inspection of vineyards for larval presence (mid-May to June) and captures of adults using by yellow sticky traps and directly from plants by means of sweep net (end of June until end of September) in 15 days intervals.

Results of monitoring showed presence of *S. titanus* in 5 of 7 localities and differences in number of collected adults depending on date of inspection and locality. Presence of larvae were recorded from end of May and during June, while first captured adults are detected in the first decade of July. In all localities population reached a peak from mid of July to mid of August. Population started decreasing from end of August and during September, when the last adults are captured.

Keywords: *Scaphoideus titanus*, distribution, monitoring, vineyards, Montenegro

The beneficial effects of different types of olive oil, flaxseed oil and their blend on CCl₄ –induced liver hepatitis in rats

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Abstract

This study was conducted to evaluate the hepatoprotective effects of olive and flaxseed oil their blend on the hepatocytes liver of rat fed on basal diet supplemented with these oils. The effect of feeding rats on deferent levels of these oils on lipid profile was studied. The results indicated that the diet containing olive, flaxseed oils (at 100% from the oil content of the diet) led to significantly increases in the weight of rats compared to the control positive group. The results showed that the diet containing olive oil, flaxseed oil and blend oils 100% substitution caused significantly decrease of total cholesterol and recorded 79.71,76.18 and 76.66 mg/dl respectively, compared to the positive control group while it was no significantly differences between these three treatments regarding to the triglyceride. The Histopathological examination indicated that after CCl₄ treatments, the livers of injured rats showed centrolobular coagulative necrosis, fatty change of the hepatocytes and dilatation with congestion in the central vein. The results revealed that feeding of rats on basal diet containing olive oil 100%, flaxseed oil 100% and mixed oil 100% lead to the best improvement in liver and significantly ameliorated the CCl₄ induced necrosis and infiltration of lymphocytes.

Keywords: Olive oil; flaxseed oil; liver histopathology; Omega-3 oils; Hepatitis

Morphological characterisation of the nematode *Aphelenchoides ritzemabosi* isolated from chrysanthemum

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Abstract

The symptoms of brown spots limited to the leaves veins have been observed on chrysanthemum from Šamac, Republic of Srpska in autumn 2018. The damage has exceeded 60 % of nursery plants. This symptom is typical for chrysanthemum foliar eelworm *Aphelenchoides ritzemabosi*. Nematode extraction from symptomatic leaves was done by Baerman funnel method. Juvenile and adult stages have been observed. The nematode identification was done by morphological and morphometrical characterization. Description of juvenile, female and male stages is presented. 20 individuals were examined on main morphological characteristics. The next morphometrical characteristics were observed for females and males: body length, a, b and c ratio, vulva position, stilet length, nerve ring position, excretory pore position. Vulva position for females was measured also. Weather conditions data were presented for this year and previous year revealing rainfall as the main factor influencing the presence of damage. Control measures are proposed.

Keywords: *Aphelenchoides ritzemabosi*; chrysanthemum pests; nematodes.

Entomopathogenic nematodes as a biological control agents in Bosnia and Hezegovina

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Abstract

First entomopathogenic nematode species was described a century ago. However, their potential in control of insect pests has been started to be exploited three decades ago, after developing of liquid cultures for their mass production. Since then, their application as a biological control agents of insect pest has been increasing exponentially. In Bosnia and Herzegovina the first survey on the presence of EPN was conducted in 2014. Totally four species have been identified for the first time in B&H: *Steinernema feltiae*, *S. carpocapsae*, *S. kraussei* and *Heterorhabditis bacteriophora*. In the laboratory and field tests potential of EPN species against adults and larva of plum sawflies (*Hoplocampa flava* and *Hoplocampa minuta*) were tested. The nematodes have shown potential to control these pests at the level close to synthetic pesticides when they applied at certain conditions. Two species of EPN were tested against adults of cherry fruit fly (*Rhagoletios cerasi*). After the nematodes application, the percentage of damaged cherry fruits was significantly decreased. Local strains of EPN produced high mortality of buxus fruit moth larvae (*Cydalima perspectalis*) in laboratory condition their efficacy in the field conditions was on a low level. EPN have showed potential in control of some pest, but their application require certain condition that have to be met.

Keywords: biological control agents; nematodes.

Composition Investigation of the Sunflower Seed of the Latest NS Confectionary Hybrids

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Abstract

Because of the favorable amino acid composition of sunflower protein and low content of antinutritive components, the confectionary/non-oil sunflower seed is increasingly gaining in importance. This is why there is a need for increasing the number of this type of hybrids. Breeding new hybrids of different characteristics are obtained. In order to investigate the composition of the seed, three samples of the latest NS hybrids of second filial (F₂) generation (NS-H-6792, NS-H-6489, NS-H-6311) were analyzed and compared with the results of the hybrid seed already-used (CEPKO). The content of moisture was determined according to EN ISO 665, the content of the oil according to EN ISO 659, while the mass of 1000 seeds and the content of hull and kernels were made according to Karlović and Andrić, 1996. The moisture content ranged from 5.75% in the sample NS-H-6792 to 6.57%, in the sample NS-H-6489. The oil content was in the range of 25.62%, found in the sample NS-H-6311 to 23.12%, found in the sample NS-H-6489. The mass of 1000 seeds determined on dry matter amounted to a maximum of 125.56 g in the sample NS-H-6311, while the smallest value was 114.22 g in the sample NS-H-6489. The highest content of the hull was found in the NS-H-6792 sample, 46.74%, while the smallest content of the hull was found in the sample NS-H-6311 and amounted to 41.91%. Although the confectionary sunflower hybrid seed is primarily intended to produce kernels, this seed contains significant amounts of oil (about 30%). It is concluded that such a seed could represent a potential raw material for oil production.

Keywords: non-oil hybrids, oil content, mass of 1000 seeds, hull/kernel ratio, hull/seed ratio

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Study on Dimensions of the Sunflower Seeds of the Latest NS Confectionary Hybrids

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Abstract

The confectionary/non-oil seed of sunflower hybrids is characterized by a higher content of the hull, which is thicker than the oil seed hybrids of sunflower. These seeds can be of different size and shape, with a hull not completely black. The aim of this study is to examine the dimensions of confectionary seeds of the latest NS sunflower hybrids. The results of the analyzed seed samples of the latest hybrids of second filial (F₂) generation (NS-H-6792, NS-H-6489, NS-H-6311) are compared with the results of already-used hybrid seeds (CEPKO). Equivalent diameter and linear dimensions of seed are characterized by Malik and Saina, 2016. The highest specific value of the equivalent diameter was 8.25 (NS-H-6792) and the smallest was 7.90 (NS-H-6311). Only 24.33% of the measured seeds were between 15 and 15.99 mm long, which is the most frequent length interval. The average seed width is from 7 to 7.99 mm (44.33%), while the average seed thickness is from 4 to 4.99 mm, which was measured in 46.67% of examined seeds. From the above results of the linear dimensions it can be concluded that the seeds are the most different in length, while the distribution of the results by width and thickness is less.

Keywords: sunflower, non-oil hybrids, size and shape, length, distribution

Acknowledgments: This work is the result of research under the projects TR 31014 and TR 31025, financed by the Ministry of Education, Science and Technological Development of the Republic of Serbia.

Diagnostics and identification of mixed infections on edible mushrooms

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Abstract

Diagnosis and identification of mixed infections on the bivalve mushroom (*Agaricus bisporus* (J.Lge) Imbach) were performed. The initial assessment of the symptoms of the disease was performed visually by the habit of the fungi. For the study of viral infection, ELISA and electron-microscopic analysis of the mycelium and fruiting homogenate was used. For bacteria and fungi used traditional nutrient medium. In order to determine the morphological features of microscopic fungi and bacteria, optical (light) and luminescent microscopy was used. To date, around 35 species of fungi are grown in the world, of which 20 are of industrial scale. Most cultivated species are edible, some of them have healing properties. *Agaricus bisporus* (Lange) Imbach, a common mushroom, the most common cultivated mushroom, is susceptible to a wide range of virus, bacterial, and fungal diseases. However, only some diseases were studied for the mechanisms involved in the host-microorganism interaction. Commercial strains produce substantial yield and exhibit attractive morphology and texture, but they are susceptible to a variety of viral, bacterial and fungal diseases. Under the conditions of the natural environment of the common mushroom and late oyster are carriers of bacteria, microscopic fungi and "spherical" virus. In conditions of production for common mushroom, lesions of the fetal bodies were detected by microscopic fungi *Verticillium fungicola*, *Mycogone perniciososa*, *Trichoderma viride*, *T. konidii*, *Cladobotryum dendroides*. Often, these mushrooms affect the *Agaricus bisporus* in a complex with a "spherical" virus. It was investigated that a spherical virus of sizes 19-50 nm. Virions are often interconnected (in vitro) in accordance with the sizes: 19, 25, 29 nm; 34, 40, 42; 50 nm. By studying the method of electron microscopy *P. fluorescens* (biotype G, -syn. *Tolaasii*), the bacterial contamination with bacteriophages was observed. This bacterium, as evidenced by various studies, has a peculiar pigment pig that gives it, developing on common mushroom, peculiar properties. Thus, the diagnosis and identification of mixed infections affecting edible mushrooms enables us to expand our understanding of the properties of viruses, microscopic fungi and bacteria.

Key words: viruses; bacteria; mushrooms; common mushroom.

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Mites in Greenhouse

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Abstract

The mites are widespread all around the world. They can be found in the all climatic zones and different elevation. Mites belongs to the class Arachnida, the subclass of Acari. They can inhabit the land, water, plants and animals. The success of this group to inhabit different areas and inhabitants is correlated with small dimensions of body (on average it ranges from 250 to 750 µm), but also in their ability to exploration of microstate. One of their characteristic is to form dense populations due to high reproductive potential and with short cycle of development.

Agroecosystems in which phytophagous mites are harmful are primarily orchards, vineyards, protected areas (greenhouses), urban greenery, nurseries, forest cultures and stored products, and to a lesser extent annual arable crops.

In the greenhouses where are relatively stable ecological conditions which are important also for optimal plant growth, mites have a chance for rapid development. Mites are pests which have rapidly developing and rapidly increasing population's size, making on that way thick colonies. Many types of mites that occur in a greenhouse cause major economic damage. The consequences of their attack on the vegetables can be multiple: direct (qualitative, quantitative, aesthetic) but also indirect. Harmfulness of certain species of mites depends on the type of diet, the depth of penetration into plant tissue, the secretion of toxic substances, the number of individuals, and / or the variety to be fed. Especially significant types of mites within the greenhouses are: *Tetranychus urticae*, common spider, which causes damage on almost all vegetable crops grown in greenhouses. *Tetranychus cinnabarinus*, carnified pauchiner, which is important for species from the Solanaceae family. *Polyphagotarsonemus latus*, broad mite, which causing very high damage to peppers in greenhouses.

Keywords: greenhouse; mites; vegetable.

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Comparison of Intercellular and extracellular phytase activity in *Lactobacillus sp.* isolated from sheep and cow's milk and yogurt in different temperature

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Abstract

Phytases can be found in bacteria, yeasts, fungi and plants. The aim of this study focused to assay Intercellular and extracellular phytase in isolated bacteria from sheep and cow's milk and yogurt in different temperatures of 5 – 25° C. Phytase activity was assayed by measuring the amount of liberated phosphate from sodium phytate and One unit of phytase activity was defined as the amount of enzyme that produces 1 µmol of inorganic phosphorous per 15 minutes The enzyme activity was measured on the basis of inorganic orthophosphate release. Intercellular phytase exhibited optimal activity at 25°C. Among different strains isolated from dairy products, the bacteria isolated from cow milk showed high intracellular and extracellular phytase activity (p<0.05). The results of this study may be used in the dairy fermentation industry for the development of functional, healthy milk, yogurts and other fermented dairy products that provide both active phytase and viable probiotics to the consumer.

Key word: extracellular, Intercellular, *Lactobacillus*, phytase activity.

Presence of viruses in the population of grapevine cultivar "Smederevka" (*Vitis Vinifera* L.) in Rasina District, Serbia

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Abstract

"Smederevka" is very old autochthonous grapevine cultivar of the Balkans. Lately, its popularity increases with DNA analyzes which showed to have a common parent as well as the "Chardonnay" variety – Gouais Blanc. Survey of virus infection incidence was conducted of nine location on Rasina district area in the Republic of Serbia in grapevine basic mother plants. The survey was published by Agricultural Service Krusevac, and as authorised institution with a professional capacity it is included into a national phytosanitary system for implementation of the system of control of prevention of taking in and out of systemic fruit tree pathogens and grapevines into the country and out of it. It also controls the existence of pathogens in main nursery plants and nursery beds. Total number of 17 samples was tested on presence of four viruses using ELISA: *Grapevine fanleaf virus* (GFLV), *Grapevine leafroll-associated viruses 1,2 and 3* (GLRaV-1, GLRaV-2, GLRaV-3). The presence of GLRaV-3 was confirmed in 4 tested samples (23,53 %). There were no other viruses in the examined samples. Conducted investigation indicates deteriorated viral sanitary status of cultivar "Smederevka" and necessity for intensifying the clonal and sanitary selection program.

Key words: Virus diseases, Autochthonous grapevine cultivar, Rasina District

Determination of some pesticide residues in apple juice by RRLC

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Abstract

Background: It is well-known that apple crops are attacked by a variety of insect pests which can reduce their yields. In order to protect apples, pesticides are widely applied. Taking into consideration the negative influence of pesticides on human health there is constant need to develop and improve analytical methods for pesticide residue determination. Methods: Rapid Resolution Liquid Chromatography (RRLC) system coupled with UV-Vis diode array detector was applied for determinations of methomyl, methidathion and propiconazole residues in apple juice. The separation and quantification of investigated pesticides was performed using reversed-phase mode and Purospher® Star RP-18 endcapped (30 mm × 4 mm; 3 µm) column. Results: The apple samples were cleaned-up using the system for solid phase extraction with a rate of 10 mL/min. The elution of pesticides from the cleanup column was performed with 100 % acetonitrile. Eluates were evaporated with nitrogen and the dried residues were dissolved and homogenized with acetonitrile. The best resolution with sharp and symmetrical peaks for the three pesticides was achieved with the mobile phase acetonitrile/water 50/50 (*v/v*) flow-rate of 1 mL/min and column temperature of 25 °C. Validation of the applied method was made testing following parameters: linearity, sensitivity, selectivity, precision and accuracy. Conclusions: The proposed method was successfully used for quantitative determination of methidathion and propiconazole residues in apple juice. Under applied experimental conditions methomyl can not be determined due to the influence of the food matrix. The investigated pesticides were not detected in the analyzed apple juice samples.

Key words: RRLC, methidathion, propiconazole, methomyl, apple juice

Determination of Bisphenol A in beverages by RP-HPLC

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Abstract

Background: Bisphenol A (BPA) is a monomer widely used in the production of polycarbonate *epoxy resins, diacrylates* and phenolic resins. A small quantities of BPA can potentially migrate into the food and thus it can be potential hazard for human and environment. Therefore, quantitative determination of BPA is of a great importance. Methods: A fast, simple, precise and economic RP-HPLC method with UV-DAD detection for quantitative determination of Bisphenol A in beverages was applied. Three analytical columns were tested: Hypersil ODS (250 mm x 4.6 mm; 5 μ m), LiChrospher 60 RP-Select B (12.5 cm x 0.4 cm; 5 μ m) and Purospher® STAR RP-18 endcapped (30 mm x 4 mm; 3 μ m). Results: Analyzed beverages were packed in plastic bottles and small glass bottles closed with a caps coated with epoxy resin on the inside. For quantitative determination of BPA following experimental conditions were established: mobile phase consisted of acetonitrile/water 50/50 (*v/v*), flow rate of 1 mL/min, column temperature of 25 °C, injection volume of 5 μ L and UV detection at 200 nm. The method was developed in an isocratic manner and with a reversed phase column. Prior the analyses the samples were filtrated through syringes Spartan – T with pore size 0.45 μ m and solid-phase extraction (SPE) was applied, as well. The following parameters were determined: retention time, linearity, limit of detection (LOD), limit of quantification (LOQ), precision, accuracy, selectivity and sensitivity. Conclusion: The RP-HPLC method with UV-DAD detection can be successfully used for quantitative determination of BPA in non-alcoholic beverages with or without pretreatment by solid-phase extraction. The BPA was not found in the analyzed beverages.

Key words: Bisphenol A, RP-HPLC, UV-DAD detection, non-alcoholic beverages, acetonitrile.

Perspectives of the environmental friendly wireworm control in sunflower

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Abstract

Sunflower production in Serbia can be limited by the occurrence of insect pests among which, wireworms (larvae of the click beetles; Coleoptera: Elateridae) are becoming more prevalent in all cropping systems. Their economic importance derives from the polyphagous preferences and prolonged subterranean development. As a result of underground feeding activity, the wireworms cause severe damages to root and lower parts of stem. The most sensitive period for sunflower plants is from the emergence up to the formation of two pairs of leaves. Thus, so far, in Serbia, wireworms were mainly controlled by insecticides applied as soil and seed treatments, along with regular agro-technical measures. However, since the beginning of 2014, neonicotinoid based insecticides (mainly used for seed treatment) are banned for use in sunflower (Regulation EU 485/2013). Due to the increased environmental concerns, pest resistance problems and phasing out of the efficient insecticides, EU member states have already promoted programs and strategies for reducing the use of synthetic insecticides. Along with economic damages, Serbia faces problems with the increase of wireworm abundance each year. The mentioned facts, along with insecticide restrictions, impose a need for novel approach and implementation of new, more environmental friendly control strategies. Key components of the environmental friendly pest management are the use of biological agents (biopesticides) and breeding for more tolerant and/or less preferent genotypes. One of the most promising and environmentally safe organisms for wireworms control are entomopathogenic fungi (EPF). Additionally, these fungi can express beneficial effects on plants (promotion of plant growth, viability, conferring resistance against abiotic stresses etc.). Recently, the EPF have become an inevitable part of a new wireworm control strategy called "Attract & Kill" ("A&K"). This strategy is based on the use of attractant component, usually CO₂ for soil-dwelling pests, combined with an EPF (*Metarhizium anisopliae*, *M. brunneum* etc.). So far, field tests involving the "A&K" strategy have not been carried out in Eastern Europe and the Institute of Field and Vegetable Crops, Novi Sad (Serbia) is the first to test the mentioned strategy in Serbian agro-climatic conditions. Breeding of crops (genotypes) that are tolerant to harmful insects is another scientific approach that is gaining attention in integrated pest management. So far, wireworms were effectively controlled by chemical agents which could be the reason why there is a lack of breeding studies for plant tolerance to these pests. Because of limited chemical control options, breeding for more tolerant genotypes could play an important role in mitigating damages from wireworms in the future. Also, the mechanisms of the host-plant resistance towards these pests have not yet been fully determined and have to be more thoroughly studied. Demonstrating the feasibility of these two strategies in different agro-climatic conditions of Serbia will contribute to their wider application potential. This is in compliance with one of the most important agricultural challenges: achieving high and stable yields, and at the same time reducing the agronomic inputs for pest management and mitigating environmental pollution.

Keywords: wireworms; environmental friendly control; sunflower, entomopathogenic fungi; plant breeding

The influence of two starter cultures on some quality properties of *Macedonian traditional sausage*

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Abstract: Sausages belong to the widest range of meat products available in a wide variety of species and with various commercial names. The aim of this paper is to monitor the influence of two starter cultures on the color and lipid oxidation of industrially produced Macedonian traditional sausage. The research covered three variants: Variant 1: Control variant (conventionally produced Macedonian traditional sausages using nitrite salt and powdered acerola); Variant 2: Macedonian traditional sausages where the basic formulation was enriched by addition of starter culture CS-300 (*Staphylococcus carnosus* ssp. *utilis* + *Staphylococcus carnosus*) in combination with Swiss chard powder and powdered acerola; Variant 3: Macedonian traditional sausages where the basic formulation was enriched by addition of starter cultures CS-300 (*Staphylococcus carnosus* ssp. *utilis* + *Staphylococcus carnosus*) and BLC-78 (*Pediococcus acidilactici* + *Staphylococcus carnosus*) in combination with Swiss chard powder and powdered acerola. The lightness of the color (L^*) continuously decreases in the control variant, resulting in a loss of color in the specified time interval. This phenomenon is not observed in the samples from variant 2 and variant 3. On the 4th day of production, variant 2 and variant 3 have statistically significant differences ($p < 0.05$) for redness value, compared to the control variant. From the aspect of retaining the values for redness (a^*) and the yellowness (b^*), better effect showed the starter culture CS-300. Thus, the samples of this variant showed better values for total color change (ΔE) and color saturation (C). The lowest TBA value was determined in the variant 2, and the highest TBA value was determined in the variant 3. According to the obtained results, with the use of the starter culture CS-300 good quality of the sausages is achieved. At the same time a safe product is obtained where the use of nitrite salt is completely eliminated.

Keywords: traditional sausages, starter cultures, color.

Determination of heavy metals in mixed flower honey

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Abstract

Honey is the most accessible bee product and it has been used since ancient times. Plants secrete nectar, in order to attract bees and they, in return, pollinate plants and create new life. Chemical compound of honey is very complex and made out of over 70 different matters. Although the chemical compound of honey is different and unique for every sample, in essence it contains: sugar, water, organic acid, mineral matters, protein, vitamins, enzyme and fat. Sudden development of industry and technology in the world caused higher pollution which reflected on to food contamination. Because of that there is a higher number of pollutant of different origin in the environment. Heavy metals are a significant pollutant. The objective of this paper was to determine the content of heavy metals in samples of mixed flower honey bought in Sarajevo municipality. Determination of heavy metals was conducted on 12 samples of mixed flower honey using atomic absorption spectrophotometric method. Heavy metals that were examined are: iron (Fe), zinc (Zn), copper (Cu), lead (Pb) and cadmium (Cd). In this research, next to content of heavy metals, content of macroelements was also determined in honey as well as physical-chemical analysis. The analysis showed that all samples meet the standards set by Rulebook on maximum allowed quantities of food contaminants (Official Gazette of BiH, 68/14, 79/16) for content of iron and copper, while 9 out of 12 samples does not meet the standards in content of lead.

Key words: mixed flower honey, heavy metals, physical-chemical analysis, Sarajevo municipality.

(3) Genetic resources

Genetic characterization of Montenegrin grapevine varieties and their conservation

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Abstract

Numerous literary data on Montenegrin grapevine varieties as well as realized scientific researches confirm the long tradition of grapevines growing in Montenegro, where the dominant place belongs to autochthonous grapevine varieties. The oldest historical document that points out the importance of grapevine growing in Montenegro and the autochthonous grapevine variety Kratošija for Montenegrin viticulture and winemaking is the Medieval Statute of Budva, which dates from the XIV century. The results of the genetic identification of Montenegrin grapevine varieties confirmed the original and unique DNA profile of autochthonous varieties Vranac, Krstač and Žižak, while for the Kratošija it was confirmed that it has an identical genetic profile as Primitivo/Zinfandel. A pedigree analysis of Montenegrin grapevine varieties has shown that Montenegrin viticulture is based on a family of genetically related varieties, which is characteristic for other famous traditional vine growing and wine production areas. In Montenegro, this family is mainly created around the variety Kratošija, which played a key role as the ancestor of many varieties that are cultivated in the old Montenegrin vineyards. Kratošija is the oldest variety cultivated in Montenegro, it has 21 descendants and it is the father of Vranac variety. The richness of the genetic diversity of grapevines in Montenegro has been confirmed by the existence of 63 new genotypes in Montenegro, which are unknown for viticulture science and profession, and which were preserved from disappearance by collecting in the National Collection at Čemovsko polje.

Keywords: genetic characterization; autochthonous varieties; Kratošija; conservation; National Collection

**** Key Note paper / Invited paper for the Session (3) Genetic resources**

Potato diversity in Montenegro

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Abstract

As in other Balkan countries, potato has been grown in Montenegro since the end of the 18th century. Due to the very favorable natural conditions, areas under potato crop have spread rapidly, and potatoes became the leading agricultural crop in a very short period. During the long period of potato cultivation, potato tubers have been brought to Montenegro many times from various parts of the world. With continuous cultivation in very different agro ecological conditions, potato have differentiated into a wide number of varieties.

At the beginning of this century, along with the intensive introduction of modern varieties, the conservation of potato genetic resources began. In the period from 2008 to 2010, 52 local potato populations were collected from over 150 localities in Montenegro.

With the aim of identifying duplicates and finding unique genotypes during 2016 and 2017, morphological and DNA characterization of conserved accessions was done. By comparing the DNA of the material of Montenegrin populations with potatoes from Scottish database (about 8000 varieties), 4 unique genotypes have been identified. All others potato populations from Montenegro have the status of a known variety. The conducted research provided a clear estimate of the value of the Montenegrin potato collection, but also significantly contributed to the reduction of conservation costs.

Key words: potato, diversity, characterization, conservation

Analysis of spike related traits in barley landraces indicates their usefulness as a source of a new variability in breeding

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Abstract

Domestication, selection and modern breeding narrow the genetic variability of barley, and thus create the need for re-integration of variability as a basis for barley breeding. In this study, 48 landraces and 4 cultivars of barley from Serbian gene bank were analysed during two years. Phenotypic variability and genetic structure of the two quantitative spike traits: length and width, and one trait of grain: 1000 grain weight, were analysed in a population with genotypes of known type of vegetation and spike form. Average spike length ranged from 4,2 to 10,2 cm, spike width 0,65 to 1,27 cm and 1000 grain weight from 27,58 to 51,35 g. Analysis of variance has significant F value for all sources of variation in all traits. Analysis with 16 SSR markers detected a total of 105 allelic forms. Observing the groups of vegetation type and spike form, diversity of genes was the highest in the spring barley (two-row and six-row forms) and six-row barley (spring and winter types). The results of AMOVA test for spike form showed highly significant values for both sources of variation, while the intergroup component was dominant both for type of vegetation (91,26 %) and form of spike (90,83 %). Based on the cluster dendrogram 52 genotypes are classified into three main groups and 11 sub-groups. The results showed there is considerable variability of examined traits in the collection, so it can be used in barley breeding programs.

Key words: landraces, spike related traits, variability, SSR markers, barley

Evaluation of genetic diversity in sugar beet (*Beta vulgaris* L.) inbred lines by SSR markers

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Abstract

Sugar beet (*Beta vulgaris* L.) is one of the most important industrial crops in temperate climates as the main source of sugar production. Molecular markers can be used to increase the efficiency of a breeding program, especially for an estimation of diversity of genotypes or for drought tolerance (Sandhu *et al.*, 2016; Kito *et al.*, 2017). The purpose of the research was to estimate the polymorphism of sugar beet genotypes based on SSR analysis for following breeding for drought tolerance. We studied ten inbred lines of sugar beet selected at Institute of Bioenergy Crops and Sugar Beet from different experimental breeding stations (EBS) and one inbred line was taken from Belarus under the Betaintercross program. The polymorphism based on DNA of sugar beet according three SSR markers (SB04, SB07 and SB15) was performed (Richards *et al.*, 2004; Ćurčić *et al.*, 2017). The grouping of genotypes in terms of SSR analysis was carried out by cluster analysis. As a result, it was determined that the frequency of identified alleles ranged from 0.05 to 0.45, the index of polymorphism on the average for studied markers was 0.80. It was found that it was determined four clusters that were formed on the basis of genotype affinity. Two inbred lines (line 28145 from Uladivka's EBS and line 26397 from Ivanivka's EBS) are not included in any cluster. The line 26397 from Ivanivka's EBS is the most remote. The most similar genotypes are line 44504 from Bila Tserkva's EBS and line 27826 from Ivanivka's EBS, line A-06626/2 from Uman's EBS and 07-168MS from Yaltushky's EBS. Genetic distances between them are 1.73. Therefore, the marker system of three SSR markers allows using it in breeding work and shows the principle of the combination of inbred lines for the strong heterosis with following breeding for drought tolerance.

Keywords: sugar beer; SSR markers; cluster analysis; genetic polymorphism

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Identification of drought resistant maize lines with DNA markers

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Abstract

DNA marker-assisted selection (MAS) becomes an attractive option for detecting inherited traits in the newly developed cultivars (Jompuk *et al.*, 2006). Drought is one of limiting factor to maize production worldwide, as 15–20 % of maize grain yield is lost every year due to drought. Evaluating drought-tolerant inbred lines and then developing drought-tolerant hybrids are the approach to minimize the impact of abiotic stress (Hao *et al.*, 2011; Liu *et al.*, 2015). The purpose of the research was to estimate SNP (single sequence repeat) polymorphism of genes *dhn1* and *rsp41* associated with drought resistance in lines of maize. It was studied 113 maize lines selected at Research Institute of Agrarian Business (Dnipro, Ukraine). The polymorphic SNP sites in the *dhn1* and *rsp41* was determined with PCR using the marker *dhnC397* (CCAAG/CCAAGG) and the marker based of the SNP polymorphism CCAG/CCGG (SNP A/G) of the *rsp41* gene (Liu *et al.*, 2015). As a result, a 164-bp segment of the *dhn1* gene was identified using the marker *dhnC397*. For the genotypes carrying the CCAAGG variant (as G genotype), PCR products was digested with *StyI* restriction enzyme and produced 131- and 33-bp bands. For identification polymorphism of *rsp41* gene was used the similar approach. Identified a 286-bp segment was digested with *HpaII* restriction enzyme. PCR products from the genotypes carrying the CCGG variant (as G genotype) generated 225- and 61-bp bands. Alleles, which were produced by enzymes are associated with drought-resistant genotypes (Liu *et al.*, 2015). Therefore, according *dhn1* genes it was found 100 lines with allele associated with drought-resistant. 82 lines were identified with G genotype of the *rsp41* gene. Alleles associated with drought-resistant for two markers were determined in 68 lines. These lines can be used for breeding of drought-resistant maize hybrids.

Keywords: maize (*Zea mays* L.); drought resistance; SNP polymorphism

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Pedigree analysis of Nonius horse in Vojvodina

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Abstract

In the process of intensification of livestock production, low-productive and less competitive breeds are suppressed. On the other hand, conservation of this breed plays an extremely important role. They represent a source of genes for improving health, resilience and better adaptation to specific environmental conditions. Due to increased application of technology and mechanization in the agriculture and transport, Nonius has lost its former role which ultimately resulted in negative effect on the population size. In order to prevent reduction and loss of genes in the further population, Nonius are included in the program for the conservation and sustainable use of genetic resources of domestic animals. The aim of this study was to perform pedigree analysis in population of Nonius horse in Vojvodina. The pedigree data were provided by the Department of Animal Science, Faculty of Agriculture, University of Novi Sad, as Main breeding organization for the Autonomous Province of Vojvodina. Processing of pedigree data were analyzed using online software PopRep 2.0 (Groeneveld et al., 2009). Pedigree file was formed for 81 animals with information about five generations of ancestors and consisting of five columns: code of the animal, father's code, mother's code, date of birth and gender. Pedigree completeness ranged from 100.00 in the first to 42.41% in the sixth generation. The importance of this parameter is reflected in evaluated of the calculated value of the inbreeding. The number of inbreeding animals is 101. The largest number of animals is in class 1 (0-5%) and there are no animals for which the inbreeding coefficient is more than 20%. The average coefficient of inbreeding in the observed population was the highest in 2015 and amounted to 2.73%. The generation interval amount 11.7 years, and it's in line with literature claims for this species.

Keywords: pedigree, Nonius, inbreeding coefficient, generation interval

Molecular characterization of Multidrug resistant *Pseudomonas aeruginosa* isolated from burn infection

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Abstract

In this study, 225 burn infection isolates of *P. aeruginosa* were collected from major hospitals in Duhok and Erbil / Iraq. They were identified and characterized using different bacteriological methods. One hundred of these isolates were randomly selected and subjected to 16 different antibiotics using disc diffusion method showed high resistancy to most tested antibiotics, 90% of these isolates were multidrug resistant, Imipeneme was considered as the most effective antibiotic effect on these isolates with resistnat rate 47%. All of these isolates were successfully amplified producing a single band of the *16srDNA* locus in all strains with a molecular weight of about 956 bp in order to confirm at molecular level that all these isolates were *P. aeruginosa*. The prevalence of three Extended Spectrum β -lactamase (ES β L) genes including (*oxa10*, *veb1*, and *oxa2*) among these isolates also has been done, *oxa10* a marker was found the most predominant gene among all other antibiotic resistance markers accounting 91 % followed by *veb1* and *oxa2* accounting 66% and 36%. The detection of five metallo β -lactamase(M β L) genes including (*vim-1*, *imp1*, *spm-1*, *sim* and *gim*) was performed, VIM-1-imipenem resistant *P. aeruginosa* (VIM-1-IRPA) was prevalent marker among all other antibiotic resistance markers accounting 46 % followed by *imp1* and *spm-1* accounting 45 % and 35 % respectively, while the prevalence of *sim* gene is found with rate 27% and *gim* with 24 %. Genotyping of all isolates (100) were also performed using ERIC-PCR analysis and assigned them into two main clones named Group A (92%) and 8% assigned as groupB, each of them assigned into different subgroups.

Keywords: Burn infection, ERIC, *P. aeruginosa*, PCR, *16srDNA*,

Evaluation of oil and protein content in oilseed rape

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Abstract

Oilseed rape is the most significant member of *Brassicaceae* family in terms of economic value. Its oil is the third largest source of vegetable oil in world (USDA, 2016) after palm and soybean oil. This industrial crop is cultivated for high quality oil used in human nutrition, as well as for biodiesel production. High level of monounsaturated and omega-3 polyunsaturated fatty acids makes rapeseed oil good for heart health. After oil extraction from seed, remains meal which is rich in proteins and is used as feed. At a moment in Europe, there is limited output of vegetable proteins used as feed (Jasinski et al, 2018). Breeding efforts are focused not only on higher yield, but also in improving oil and meal quality of oilseed rape. Main goal of this research was to examine oil and protein content of 39 genotypes (lines, cultivars and one hybrid) from IFVCNS (Institute of Field and Vegetable Crops in Novi Sad) collection of oilseed rape. Oil content was determined by magnetic resonance analyzer (Newport 4000 NMR). Determination of total protein amount was performed with standard Kjeldahl (1883) method. Average contents of rapeseed oil and proteins are 40-45% and 18-25%, respectively. In this study, oil content was presented as percentage of seed and varied from 28,70% in NS-H-R3 father line to 48,51% in cultivar Jovana. Four genotypes, Zorica, 36R, 37R and Jovana had more than 45% of oil. Protein content ranged 19,22-26,02% with lowest value in genotype 37R and highest value recorded in NS-UR-14 father line. NS-UR-14 and Galickij had more than 25% of proteins. According to our results, contents of oil and proteins were in high significant negative correlation ($r=-0,717$). This study pointed out on rapeseed genotypes with higher levels of oil and proteins than average and thus gave us guide marks for further breeding.

Keywords: oilseed rape; oil content; protein content

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Chemical characteristics of fruit of some genotypes of wild apple (*Malus sylvestris* Miller) grown in conditional of Bijelo Polje

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Abstract

This study described some chemical characteristics of fruits in 9 genotypes of wild apple (*Malus sylvestris* Miller) in the ecological conditions of Bijelo Polje (Montenegro) in period 2010 to 2012. The study focused on the chemical characteristics - dry matter, total soluble solids, pH, and total acidity. Dry matters were determined by drying at 105 °C. Total soluble solids were determined by refractometer. The acidity was measured by titration with 0.1 N NaOH [AOAC, [1]]. The values for fruit dry matter ranged from 14.6% ± 0.28 to 17.58% ± 0.12, total soluble solid contents ranged from 6.90% ± 0.25 to 8.62% ± 0.32, and titrable acid contents ranged from 1.03% ± 0.1 to 1.35 % ± 0.2. The aforementioned data on the chemical composition of the fruits of the studied genotypes of wild apple (*Malus sylvestris* Miller) have a general biological significance. Besides, the data proved that genotypes of wild apples are suitable for the production of apple vinegar and apple cider (local name: vodnjika).

Keywords: wild apple; genotypes; chemical characteristics

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Yield components and genetic potential of two-rowed barley

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Abstract

The aim of this study was to determine the significance of the source of the yield variability and components of the two-rowed barley, as well as the varieties and lines based on the investigated properties and the extraction of superior genotypes that exhibit high and stable yields. The average stem height for all examined genotypes of two-rowed barley ranged from 75.70 cm (2009/10) to 77.87 cm (2008/09), while the average stem height was 76.79 cm. The length of spike of the studied genotypes of two-rowed barley ranged from 8.32 cm (2008/09) to 8.50 cm (2009/10), while the average was 8.41 cm. The number of grains per spike of the studied genotypes of two-rowed barley ranged from 22.50 (2009/10) to 22.69 (2008/09), while the average was 22.59. The grain weight per spike of the barley in the area of Zaječar ranged from 1.066 g (2009/10) to 1.122 g (2008/09), while the average was 1.094 g. Correlations between the length of spike and number of grains per spike and grain weight per spike in the examined genotypes of two-rowed barley at the location Zaječar showed a positive value both in the vegetations 2008/09 and 2009/10 of the study.

By comparing the varieties and lines, it can be noted that the lines of the two-rowed barley were somewhat lower which is in line with the fact that in modern breeding programs significant results are achieved in reducing the height of the stem. The height of the stem in new varieties of barley has been significantly reduced and ranges from 60-80 cm (Dodig, 2000). Pržulj (2001) considers that in the further breeding of winter barley the height of the stem should be shortened by about 10-20 cm, and further changes should be directed towards the thickness of the stem and finding the anatomical structure that will provide sufficient strength.

Keywords: quality, productivity, barley

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(4) Phytochemistry and Medicinal Plants

Production of medicinal plants in Montenegro

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Abstract

The great wealth of diversity and favourable natural conditions provide good opportunities for collection and plantations of medicinal plants in Montenegro. Although Montenegro has excellent conditions for the production of a large number of medicinal plant species, trade with these plants is still underdeveloped, significantly less developed when compared to the market in the neighbouring countries. Therefore, Montenegro appears as an exporter on the international market of mostly unprocessed plant material. Due to the lack of reliable statistics, it is difficult to give a precise estimate of the value of total annual trade, but it is obvious that it is constantly increasing every year.

With the growing global demand, pressure on the existing populations of medicinal plants is growing. Such trends imply the need to find new opportunities to increase their cultivation on plantations. Although the collection of wild medicinal plant species in nature is the most common way of exploitation of these resources in Montenegro, in recent years, thanks to the extensive budgetary support, interest in plantation is increasing. The increase in areas under plantations is the result of accelerated depopulation of rural areas and growing demands for raw materials of uniform quality.

Despite favourable conditions, the plantation production of medicinal plants in Montenegro takes place on only 80 hectares. Since the level of processing of plant raw materials (essential oils, cosmetic and medicinal products, spices, teas, etc.) is still insignificant, future of this production will depend directly on the development of processing capacities.

Key words: medicinal plants, plantation production, processing capacities

**** Key Note paper / Invited paper for the Session (4): Phytochemistry and Medicinal Plants**

Chemical composition and antimicrobial activity of the essential oils from Montenegro

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Abstract

Medicinal and aromatic plants have the ability to inhibit the growth of a wide range of pathogenic microorganisms due to presence of essential oils. Essential oils, their chemical composition, antioxidant and antibacterial activity affect numerous physiological processes, in both plants and humans, and thus protect against free radicals and growth of pathogenic microorganisms.

This study across EUREKA project E!9906 investigates chemical composition and antimicrobial activity of essential oil of *Thymus vulgaris*, *Salvia officinalis*, *Lavandulla officinalis*, *Asphodelus aestivus* from Montenegro. The oils was analyzed by GC-MS technique in order to determine the majority compounds while dilution method was used to determine minimal inhibitory concentration MIC in evaluation of antimicrobial effects.

All essential oils have antimicrobial activity against wide spectrum of pathogenic: *E.coli*, *L. monocytogenes*, *S. enteritidis*, *S. aureus*, *P. mirabilis*, *Bacillus sp.* The essential oils of *L. officinalis* and *S. officinalis* showed antimicrobial effects with MIC ≥ 1.4 $\mu\text{l/ml}$; the thyme oils with MIC ≥ 3.1 $\mu\text{l/ml}$. The investigated essential oils consisted mostly of oxygenated monoterpenes. The major components of the oils are: *L. officinalis* (linalool 24.84% and linalyl acetate 22.39%); *T. vulgaris* (thymol 38.88%, p-cymene 20.28%); *S. officinalis* (alpha thujone 33.58% and 1.8 cineole 10.04%).

These results suggest the potential use essential oils as natural antimicrobial agents in pharmaceutical industry and food management.

Key words: essential oils, antimicrobial activity, *Lavandulla officinalis*, *Salvia officinalis*, *Thymus vulgaris*

Extraction of total phenolic compounds from unfermented tobacco by using different solvents

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Abstract

Bioactive phenolic compounds obtained from plants and industrial crops are powerful antioxidants with increased interest for application in medicine. Due to the presence of around one hundred phenolic compounds, tobacco is also regarded as a potential source of natural antioxidants.

In this paper was studied the effect of the solvent used in the extraction of total phenolic compounds from unfermented leaves of oriental tobacco type Basmak, variety MK-1 and MB-2. The ultrasound-assisted extraction was performed by using methanol, acetone, and ethanol as solvent in concentrations of 50 v/v%, 75 v/v% and 100 v/v% at solid-to-liquid phase ratio of 1:50 w/v, 40 °C, 30 min and power of 300 W. In comparison, *Soxhlet* extraction was performed for 5 hours by using aqueous methanol (80 v/v%) and 1:20 w/v solid-to-liquid phase ratio. The yield of obtained extract was expressed in gram per gram of dry plant material (g/gDW). The content of total phenolic compounds expressed as milligrams of gallic acid equivalent per gram of the dry plant material (mg_{GAE}/gDW) was determined by *Folin-Ciocalteu* method described by Wang *et al.* [2017].

The highest extract yield was obtained by using 100 v/v% methanol, 31.30 g/100 g DW for variety MK-1 and 30.22 g/100 g DW for MB-2. The extracts obtained with ethanol (100 v/v%) were characterized with the highest quantity of total phenolic compounds, MK-1 (121.70 mg_{GAE}/g DW) and MB-2 (110.33 mg_{GAE}/g DW). The extract quantity and the total phenolic content in extracts obtained by *Soxhlet* extraction were 29.10 g/100 g DW and 97.71 mg_{GAE}/g DW for the variety MK-1, and 28.61 g/100 g DW and 89.91 mg_{GAE}/g DW for the variety MB-2. These results indicated that the extracts of the unfermented tobacco leaves could be an economical source of phenolic components.

Keywords: tobacco variety, solvent, extraction, extract, total phenolic compounds

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Investigation of gross content of polyphenolic compounds in edible plants of the Carpathian region as a potential source of BACs in the composition of the novel pharmabiotic

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Abstract

Edible plants of the Carpathian region and their waste are a potential source of biologically active compounds (BACs) for novel pharmabiotics. The selection of edible plants for the study and the analysis of available plant material were carried out based on our findings and literature data on their specific activity and potential resource as a prebiotic component of novel pharmabiotics: biologicals, the effectiveness of which is clinically proven. The purpose of this paper is to determine the total content of polyphenolic compounds (PC) in various types of edible plants of the Carpathian region and their waste, potentially rich in BACs. Determination of the total content of PC in the extracts of our tested edible plants showed that the greatest number of them were found in green parts of parsley (75,8 mg), blueberries (136,4 mg), blackcurrants (127 mg), celeriac (174.3 mg), red grapes (196.3 mg), and especially in red grape grist (824.5 mg). It is known that PC of red and blueberries are often represented by anthocyanins. According to the content of anthocyanins, the most prospective source of prebiotic compounds for the novel pharmabiotics appeared to be blackberries (58,1 mg), blackcurrants (113,6 mg), raspberries (12,6 mg), red grapes (168,2 mg), and red grapes grist (605,7 mg). The content of anthocyanins in blackcurrant berries (113,6 mg) is especially high, which is quantitatively comparable to the total content of polyphenols (127,3 mg), and the same pattern has been found for grape grist, and this supports the potential of its processing in the region. For a selected number of edible plants and their waste, the gross content of PC was determined, and the most promising of them for the usage as pharmabiotics components were identified.

Keywords: edible plants; polyphenolic compounds; pharmabiotics; biologically active compounds.

Nutritional and bioactive compounds in the wild oregano (*Origanum minutiflorum*)

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Abstract

Due to the complex chemical composition, the extracts and the essential oils of the oregano species are widely used in the food, cosmetic and pharmaceutical industries (Leyva-López *et al.*, 2017).

In this study, the wild oregano (*Origanum minutiflorum*) cultivated in the Republic of Macedonia, was researched to determine the content of its nutritive and bioactive components. The samples of grinded wild oregano (0.25 mm particle size) were examined for content of dry matter, proteins, fats, cellulose and caloric value. Also, the wild oregano samples were extracted by using *Soxhlet* method (96 v/v% ethanol, 1:30 w/v solid-to-liquid phase ratio, 300 min) and hydrodistillation by *Unger*-type apparatus (1:15 w/v solid-to-liquid phase ratio, 180 min). The yield of extract and the essential oils, and the content of bioactive compounds such as chlorophylls, carvacrol, linalool and thymol were followed during the extraction.

The wild oregano was characterized with 95.91% content of dry matter and caloric value of 4435 cal/g. The content of proteins, fats and cellulose expressed in grams per 100 g dry matter (DW) was 8.37g/100 g DW, 4.54 g/100 g DW and 11.15 g/100 g DW, respectively. The obtained extract yield was 12.38 g/100 g DW. The extract had total chlorophylls of 5.08 mg/g extract. The quantity of essential oils extracted by hydrodistillation was 1.18 w/v. In the essential oil the following bioactive constituents were determined, 71.15% carvacrol, 4.12% thymol, and 6.74% linalool. The results show that the wild oregano (*Origanum minutiflorum*) cultivated in the Republic of Macedonia, is characterized by high quantities of nutritional and bioactive constituents.

Keywords: wild oregano, nutritive components, extract, chlorophylls, carvacrol, linalool, thymol

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Leyva-López, N., Gutiérrez-Grijalva, E.P., Vazquez-Olivo, G. & Heredia J.B. (2017): Essential oils of oregano: Biological activity beyond their antimicrobial properties. *Molecules*, 22, 989; doi:10.3390/molecules22060989.

Dynamics of annual natural weight rotated in lincura's sprout (*Gentiana lutea* L.)

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Abstract

The roots of yellow gentian lutea (*Gentiana lutea* L.) have long been used in large quantities in the pharmaceutical industry, but much more for the industrial production of bitter alcoholic beverages. The production of quality planting material is very important for the beginning of revitalization of gentian lutea on natural habitats, but also for its plantation production in Montenegro. The cultivation of gentian lutea, as with other medicinal plant species, represents a safe way of protecting and conserving them in free nature, especially those species whose survival is endangered by over exploitation.

Materials

The paper presents the results of the study of seven genotypes of gentiana lutea from natural populations in the northern part of Montenegro: Bjelasica (Strmenica), Bjelasica (Kobilja glava), Durmitor, Korita (Gutavica), Korita (Konjska reka), Prošćenske plsnine and Sinjajevina (Prelija)

Technique

The collected seed was planted in natural conditions in open lei in the selected location Bjelasica (Glavaca) at an elevation of 1,100 m above sea level and has favorable soil properties for the cultivation of lynx. During breeding the seedlings are regularly watered with the application of mechanical weed destruction. The control of seed growth was carried out on the third day of 07.07; 07.08 and 07.10.2010. Samples were measured on a laboratory scale.

Results

The average increment of sprout was 0.0501gr in sprouts that are from the natural population from Sinjajevina (Prelija) and the highest 0.1660gr in seedlings originating from Bjelasica (Kobilja glava). The highest increase in the first measurement was observed in the seeds from Korita (gutavica); in the second measurements, the largest mass of 0.0498 gr had whiteheads (prelije), while on the third term the highest mass of 0.1831gr had seeds from Bjelasica (Kobilja glava)

Conslusion

The quantity and quality of herbal medicinal raw materials depends on the origin of the genetic material and the ecological parameters of the site

Acknowledgments

We would like to express the deepest gratitude to the Ministry of Education and Science of Montenegro for the financial support of three- year scientific research project "The examination of the possibility for gentian seedling production as well as the environmental and biodiversity protection" (No. 06/3-2302/7).

Keywords: *Gentiana lutea*, roots

Propagation of *Plumbago indica* L. (Plumbaginaceae) through direct organogenesis and induction of callus

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Abstract

Plumbago indica L. (Family Plumbaginaceae) has many therapeutic uses in a wide array of diseases. Plumbagin is the major bioactive compound in *P. indica*. In natural habitats, this plant is under severe threat due to the non-availability of proper cultivation system and exploitation by local communities. Tissue culture methods offer an alternative means of vegetative propagation. This research was carried out on callus induction and plantlet regeneration through direct organogenesis. Mother plants were maintained in a shade house free from pests and diseases. Nodal segments were collected from second to third fully opened leaves and cut in to 1.5 cm. They were cultured on MS medium supplemented with 1.0 – 3.0 mg/L BAP. Half strength MS medium with 0.2 – 0.6 mg/L IBA was used for root induction. Leaf disc, inter nodal and nodal explants were cultured in MS medium supplemented with 3.0 mg/L BAP, 1.5 mg/L Kn and 1.0 mg/L NAA for callus induction. Nodal explants grown in MS medium supplemented with 1.5 mg/L BAP gave the maximum shoot length (1.82 ± 0.3 cm) and maximum multiple shoot induction (5.20 ± 0.4) was observed in 2.0 mg/L BAP. Half strength MS medium supplemented with 0.4 mg/L IBA was the best for root induction (9.4 ± 1.1). Best callus induction was observed from leaf disc explants in MS medium supplemented with 3.0 mg/L BAP, 1.5 mg/L Kn and 1.0 mg/L NAA.

Keywords: Phytochemicals, Plumbagin, *Plumbago indica*

Extracts of edible plants as potential inhibitors of the biofilm formation

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Abstract

The contamination of pathogenic microorganisms on the surface of food products results in rapid food spoilage and significant financial loss due to product damage. The purpose of our study was to select the extracts of plants rich in biologically active compounds with a strong antibacterial effect. Selected for the research were the extracts of *Prunus cerasifera*, *Ribes x nidiglolaria*, *Prunus avium*, *Vaccinium myrtillus*, *Prunus domestica*. The spectrum of antimicrobial activity of the edible plants extracts was studied in relation to different types of bacteria: nosocomial infections (*P. mirabilis*, *S. aureus*, MRSA, *E. cloacae*, *P. aeruginosa*) and food poisonings agents (*S. enterica*, *E. coli* EPEC, *Y. pseudotuberculosis*), commensal intestinal bacteria (*E. coli* 058, *E. faecalis*), and probiotic microorganisms (*L. acidophilus*, *L. cateniformis*, *L. casei*, *L. fermentum*). According to the results, *Prunus cerasifera* extract was characterized by antimicrobial activity against all tested microorganisms, except *B. subtilis* 090. The extract of *Prunus avium* did not inhibit only the growth of *P. mirabilis* and simultaneously stimulated the growth of *L. casei*, *L. cateniformis*, *L. fermentum*. The *Prunus domestica* extract did not exhibit antimicrobial activity only against *B. subtilis* 090 and *P. aeruginosa*, but it stimulated the growth of all tested strains of lactobacilli: *L. acidophilus*, *L. cateniformis*, *L. fermentum*. The *Ribes x nidiglolaria* extract was also characterized by a similar spectrum of antibacterial activity, whereas it selectively inhibited the growth of *L. acidophilus*. The absence of antibacterial effect of *Vaccinium myrtillus* extract was observed in relation to *Y. pseudotuberculosis* strain. The same extract exhibited a weak antibacterial effect on *E. cloacae*, *E. coli* 058, *E. coli* Schaedler's strains, however, we noticed its significant pro-bacterial activity - the ability to stimulate the growth of the commensal microbiota members. The investigated *in vitro* experiments and experimental samples strictly specifically stimulate beneficial bacterial strains and inhibit the growth of potentially pathogenic microorganisms.

Keywords: nosocomial infections, edible plants

Using plants as a tool for human microbiome correction

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Abstract

Recently, the potential use of plants in medicine has been substantially rediscovered. On the one hand, it is due to the recognition of the vital role of the microbiome in the development and progress of numerous infectious and noncommunicable diseases, and on the other hand, it is a result of a proven ability to effectively modify the microbiome state and therefore to treat / prevent a number of diseases by biologically active compounds (BAC) of vegetable origin. Using plants to change microbiome is one of the key aspects of P4 medicine, as each person's microbiome is unique and dynamic. This feature determines the need to develop information technologies to calculate personalized nutrition plan using plants and to create personalized BAC-containing medications of the new generation – pharmabiotics.

In this paper we present the results of over 5000 experiments we had studying the effect extracts / BACs of 80 plant species have on more than 40 key representatives of the gut and other microbiomes. Blackberry, jostaberry, black currant, red currant, sweet cherry, and red bilberry appeared to be the most active ones in terms of suppression or stimulation of microorganisms.

A database was created with the content of BACs in edible and medicinal plants. It has more than 8,000 plant species, 2700 BACs (with properties description) and more than 70000 data on the content of specific BACs in particular parts of certain plants species. Moreover, there is geographic information on the prevalence of local plant species (required for the functioning of our geographic information system). Numerous IT tools have been developed, including those that provide a novel possibility to perform plant selection to modify and balance microbiome either by personalized diet, or pharmabiotics. The databases and IT tools are a part of our information system, which is being tested in clinical studies.

Keywords: microbiome, plants, biologically active compounds, databases, information system

(5) Animal husbandry

Proteolytic changes during the ripening period of the Kuči cheese

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Abstract

In Montenegro, high-quality cheeses are produced for centuries according to traditional technologies. The most famous are white brined cheeses. One of them is Kuči cheese that is recognizable by the specific taste that differs from other cheeses due to a more pronounced degree of proteolysis.

The objective of the study was to analyse the process of proteolysis during ripening of Kuči cheeses. The cheeses are supplied from 12 producers that produce cheese by traditional technology. The analyses include total protein content in cheese analyzed by FTIR Spectrophotometry method (IDF141C: 2000). The degree of proteolysis was monitored by electrophoresis (SDS PAGE). SDS-PAGE was performed according Laemmli (1970). Cheeses were also analysed for water-soluble nitrogen content (WSN) according to the method of Kuchroo and Fox (1982), 5% phosphotungstic acid soluble nitrogen (PTAN), according to Stadhouers method (Stadhouer, 1960) and expressed as a percentage of WSN and PTAN of the total nitrogen matter (WSN/TN and PTAN/TN) and also as a percentage of PTAN of the WSN (PTAN/WSN). All analysis were done at 10th, 20th and 30th day of cheese ripening. Four samples of cheeses were analyzed for each ripening period. The content of proteins increased during the ripening period. Average content at 10th day of ripening was 16.77%, at 20th day 17.05% and at 30th day 17.28%. The percentage of proteins for the cheeses, individually, varied from 14.39 to 19.49%. Parameters that determine the process of proteolysis increased during 30 days of ripening. The water-soluble nitrogen (WSN) presented as a percentage of total nitrogen (WSN/TN) ranged from 13.33 to 44.32%. Also, nitrogen soluble in 5% phosphotungstic acid presented as a percentage of WSN (PTAN/WSN) varied from 3.79 to 21.57%. Those preliminary results indicate to uneven conditions of ripening that directly affect the course of proteolytic changes during ripening. The high variability of the protein content and proteolysis parameters of Kuči cheeses are due to the lack of standardized cheese-making technologies. Considering the scope of the research, it is not possible to define strictly what are the optimal values of the degree of ripening of the Kuči cheese. In order to come to certain conclusions, it is necessary to continue research with a focus on the analysis of a larger number of samples.

Key words: cheese, proteins, proteolysis, electrophoresis

Effectiveness of mycotoxin adsorbents in reducing the harmful effects of ochratoxin in laying hens

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Abstract

Mycotoxins are secondary metabolites that are produced by moulds stressed by environmental and management factors, such as extreme temperatures, drought, flooding and harvesting techniques. One mould can produce several mycotoxins, and one mycotoxin may be produced by several different moulds. The World Health Organization estimates that approximately one quarter of the world's food supply is contaminated with at least one type of mycotoxin. More than 300 mycotoxins are known so far but only a small number are relevant to the feed industry. These major mycotoxins include aflatoxin (AF), deoxynivalenol (DON), fumonisin (FUM), ochratoxin (OTA), and zearalenone (ZEA). Therefore, the use of mycotoxins binders in animal feeds becomes necessary to combat mycotoxins and, in this article, focus on effectiveness of mycotoxin adsorbents in reducing the harmful effects of ochratoxins in laying hens has been highlighted. Based on research results the OTA expressed a negative impact on body weight and feed consumption in the applied concentrations. Addition of OMC 0,2% in the feed, improves all production parameters in laying hens, regardless of whether they are fed with or without OTA. The feed consumption in hens treated with OTA was lower compared to the results in other groups. Adding OMC in food contaminated with OTA showed a protective action with respect to harmful effects of mycotoxins on the observed physiological parameters in hens. A clear protective effect against OTA, OMC exhibited on the number of laid eggs, while the same effect was observed in the average weight of yolk. The addition of the OMC in the hens feed contaminated with OTA, decrease in the intensity and frequency of histopathological changes in the kidneys tissue. All the results obtained showed that organically modified clinoptilolite (OMC), is a potent adsorbent, which can reduce the harmful effects of mycotoxins on the health and production parameters in animals.

Key words: mycotoxins, metabolites, mycotoxins binders, adsorbents, ochratoxins

High alpine pasture botanical composition and biomass quality

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Abstract

Semi-natural pastures constitute a very important part of the agricultural land of Montenegro, about 94.3% of the total utilized agricultural area. Natural pastures in Montenegro cover poorer land, inadequate for intensive exploitation and they are the most important forage sources, especially in mountainous areas. The aim of this study was to estimate biomass chemical and botanical composition of high alpine pasture in Durmitor mountain. Data on floristic composition and structure of plant communities were gathered using the standard Braun-Blanquet methodology in plant vegetative phase. Samples of forage were collected from the pastures according to procedure AS-1064 (2012), and chemical analyzes were done according to AOAC (2000). This pasture community consists of 59 species, belonging and 20 families. In the general taxonomical spectrum of families dominant was *Poaceae* (20.3%), *Asteraceae* (13.5%), *Caryophyllaceae* (11.8%), *Fabaceae* (10.2%) and *Lamiaceae* (6.7). Other families were less represented. Group of dominant species consists of: *Festuca rubra*, *Agrostis capillaris*, *Linum alpinum*, *Bromus erectus*, *Lotus corniculatus*, *Brachypodium pinnatum*, *Festuca bosniaca*, *Phleum alpinum*, *Onobrychis montana subsp. Scardica*, *Euphorbia myrsinites*, *Bupleurum falcatum*, *Silene sendtneri*, *Astragalus vesicarius*, *Minuartia bosniaca*, *Sedum sexangulare* and *Sesleria robusta*. The average content of biomass dry matter was 30.1%, crude protein 12.9%, total fat 1.86%, crude fibers 27.6% and ash 6.12%. According to floristic composition and biomass quality, this alpine pasture can be qualified as a moderate to good quality, very diversify grassland. The biodiversity of pastures has been little studied in Montenegro, even in Southeast Europe, so these results will help the pasture classification and quality estimation in Montenegrin.

Keywords: grassland; pasture biomass; floristic composition.

Challenges of IoT in Agriculture

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Abstract

The latest developments in agriculture show the enormous impact of ICT, especially IoT. IoT as comprehensive technology is capable to bring many advantages to agriculture and connects different agricultural stakeholders. Because IoT connects physical devices (mostly different kind of sensors) to the real world and thus producing enormous amount of data, the main challenge is how to use in a proper way these data. Also, important challenges are integration of IoT solutions in existing ICT systems, perception of all agricultural stakeholders of importance to bring digital technologies in any farms, fields, transportations, markets... In this paper are presented different approaches to overcome challenges of IoT implantation in agriculture.

Keywords: IoT; precision agriculture; farm management

Comparative Study of Kope Cheese quality Produced from Cow and Sheep Milk

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Abstract

Kope cheese – an Iranian traditional type of cheese - made from sheep's milk without inoculating the starter culture is ripened underground in a clay pot. In this study, the effect of milk origin (sheep's milk and cow's milk) on the some chemical factor of Kope cheese was investigated. Based on our findings, except for pH and titratable acidity, other physicochemical properties of Kope cheese were affected by milk type ($P < 0.05$). The final fat content of prepared Kope cheese produced from ovine and bovine milk were 26.82 ± 0.15 and $23.34 \pm 0.67\%$, respectively. Fatty acids most represented in the analysed cheeses were palmitic and oleic acid that their values

Keywords: Kope cheese, cheese composition, fatty acid.

Significance of European foulbrood of honey bees diagnostics in Montenegro

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Abstract

The European foulbrood disease of honey bees is a contagious disease primarily of open and rarely of covered bee brood caused by gram positive round bacteria *Melissococcus plutonius*. From the larvae that died of the European foulbrood disease also other bacteria have been isolated: *Enterococcus faecalis*, *Achromobacter euridica*, *Paenibacillus alvei* and *Brevibacillus laterosporus*, but they do not affect the appearance of the disease. These bacteria are involved in the process of degradation of dead larvae. European foulbrood disease is on the list of dangerous infectious diseases of the International Organization of epizootic diseases (OIE). Due to the weakening and deterioration of the affected bee colonies, the disease leads to great losses. At the outbreak of the disease crucial influence have adverse environmental conditions and the mistakes in technology of breeding of bees. Larvae are infected with food contaminated with *Melissococcus plutonius*, also by mites *Varroa destructor*. Symptoms of the disease are visible on the open bee brood; the larvae change color to pale yellow, then dark brown, with semi - solid consistency and then disintegrate. Measures of diagnostics, suppression and control of this disease are performed under the supervision of a veterinarian. According to the Rules on classification of contagious animal diseases... (Official Gazette of Montenegro No 92/2017) beekeepers in Montenegro are under obligation to report to the veterinary service any doubt on this disease. The Food, Veterinary and Phytosanitary Directorate within the Ministry of agriculture of Montenegro is under an obligation to report confirmed cases to the OIE. Very weakened bee colonies are being destroyed. If the bee colonies are strong, measures are taken for healing the affected colonies. Due to many adverse effects, antibiotics use is prohibited. There are no data on the presence of this disease in Montenegro or systematic control of the bees to this disease. Therefore, for the purpose of health care of the bees diagnostics of this disease should be done with the implementation of regular annual control of the bees for this disease. These activities should be carried out by the veterinary services and coordinated by the Food, Veterinary and Phytosanitary Directorate.

Key words: European foulbrood disease of honey bees, *Melissococcus plutonium*, Montenegro, bee disease

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(6) Rural development and agro-economy

The rural policy of Slovakia after joining the EU

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Abstract

Rural areas represent about 92% of the territory in the EU-28. These regions produce around 45% of gross value added (HPH) in the EU-28 and represent more than half of jobs. Rural development must be able to meet market requirements and ensure adequate food quality and protection as well as the protection of environmental policy. The main players in rural development are the following factors: impact of technologies, development of domestic and foreign markets, benefits in communication and transport and population migration. As a member state of the European Union, the Slovak Republic has the possibility to use the supporting policy instruments for the development of rural areas, agriculture and society as such. This also serves the Rural Development Program 2014-2020. The program belongs to documents of a national nature and represents a rural development strategy through various measures grouped in line with the axes such as: increasing the competitiveness of the agricultural and forestry sector, improving the environment, the quality of life in rural areas and the diversification of the rural economy to which it is directed assistance exclusively from the European Agricultural Fund for Rural Development.

Keywords: rural development, agriculture, environmental technology, population, regions, demographics.

**** Key Note papers / Green Room Sessions 2018 International Conference Invited speaker**

Innovation in agriculture in the Republic of Serbia

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Abstract

Digitization and the introduction of new technologies are not a feature of only one specific area but affect the entire economy, so agriculture is not spared. In order to increase the yield and quality, the losses, not only young farmers, but also all who want to secure and maintain their position on the market, to be competitive, turn to digitization and new technologies. More modern and better use of available natural resources, knowledge as well as renewable and non-renewable resources is gaining importance. Knowledge is a very important factor, because it can be carried out in an innovative way in an innovative activity in business and agriculture, innovation can be applied. Various new applications appear on the market, new services that facilitate and speed up the production process and encourage efficiency. The application of technologies, new equipment and innovation in agriculture increases yields and encourages the monitoring of changes taking place on the market. The aim of this paper is to present the current situation regarding innovation in this area in the Republic of Serbia in order to provide adequate guidance for some future period.

Key words: Innovation, agriculture, new equipment, efficiency, digitization

Agricultural policies and rural development of Montenegro

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Abstract

The subject of the research was to study the previous measures of agricultural policy as part of economic policy and analyzes of rural development of Montenegro, proposing at the same time guidelines and options for further development. How much has Montenegro done on this issue is also one of the research questions in this paper. The subject of the research is, more broadly speaking, the development of a model of development from which the appropriate agrarian policy arises. The survey takes into account the issue of agriculture and tourism relations, analyzes the problems of the Montenegrin village, demographic discharge and a number of other negative phenomena that accompany the development of this Balkan state. The problems studied and recommendations provided are relevant also for the other countries in the Region, and their resolution depends on the pace of accession to the European Union. The way on how we are going to solve rural development issues will directly determine future development of agriculture and rural areas of this country. The research emphasized that modern transitional processes should be theoretically designed. The practical significance of this research is the establishment of the correct state relations towards agriculture and rural areas, development of entrepreneurship in agribusiness, development of farming, and its revitalization. The research has raised the focus of the question how far the external factors influenced the necessity and pace of these reforms, and how much the internal factors? What is the platform of transitional reforms, what are the goals, and what are the pillars of transitional reforms in agriculture in Montenegro? The models of economic development from which the agrarian policy arises are analyzed. The subjects of the research were some segments of the concept of transitional reforms. The study provided the analysis of contains of the reform of agrarian policy. Furthermore the research questioned how important is the harmonization of agricultural legislation? What does institution-building is bringing? What happens to the market-price agrarian policy? What is the status of rural development policy in Montenegro? Analyzes highlighted the significance of the new tax and social policy, environmental policy, and the agricultural budget policy. The paper presents an analysis of the current development of agriculture and rural areas of Montenegro, the current situation in this development, as well as the development perspectives from the aspect of the transformed agrarian policy and the new concept of rural development. In the center of the analysis, two key macroeconomic instruments of development were set up: agrarian policy and rural development. Two concepts of development of agriculture of Montenegro have been presented. Prior to independence, it was pointed out that the concept was harmonized with the concept of the states that were in the same union (the Kingdom of SHS, SFR Yugoslavia, FR Yugoslavia). In the first, old Yugoslavia, Montenegro, as well as other less developed republics, the problem of agrarian overpopulation was monitored. In socialist Yugoslavia there was a deagrarianization problem. In the last State Union, we highlighted the problem of the

discharge from the rural areas and the dilution of agriculture, due to the social problem of the population. The independence of Montenegro has begun to conceive and implement the new concept of agrarian policy and rural development, aligning it with the EU concepts. Among all the Montenegrin economists and agro economists there is a consensus about the importance of agriculture in the economic development of the country, as well as on the necessity of the establishment of new concept of development. The previous initiatives in this field should be sublimated in a comprehensive analysis of this strategic issue of socio-economic development of this country.

Keywords: Agrarian Policy, Rural Development, Economic Policies, Harmonization of Legislation.

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Contemporary problems of agriculture and the countryside – Experiences of the Republic of Serbia

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Abstract

The Republic of Serbia has rich economic conditions for the development of agriculture (5,097,000 ha of agricultural land). Serbia also has qualified and educated human resources and appropriate institutions (secondary schools, faculties, institutes), as well as a long tradition of peasant or agrarian state. Serbia also has solid potential for the development of the food industry.

Despite all this, agriculture and the villages in Serbia are in the process of decay, devastation and lagging. Agricultural production in the period of 2000 - 2017, for example, grew in only a few years. And the level of processing is relatively low. The negative development trend is accompanied by deagrarianization and demographic runoff of the village. There are many reasons to this. A new strategy for sustainable agricultural development and agrarian policy is needed.

Key words: agriculture, village, problems, agrarian policy, Republic of Serbia.

Mechanism Formation of Effective Social and Economic Relations Forms in the Countryside, Russia

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Abstract

Russian rural territory over a quarter of a century, is in the process of transformation, which is accompanied by a restructuring of all spheres of the agricultural way of life, the formation of a new socio-economic relations. Over the recent years, productivity significantly increased in agricultural production. However, the condition of agrarian economy in Russia is still far from perfectness. The number of workers employed in agricultural production reduced in several times, migration flows of working population from villages to towns intensified. Because of insufficient capital investment and the engineering and social infrastructure of the village is declining. Growth of differentiation in incomes of urban and rural residents, unemployment in rural areas, reducing the number of socio-cultural sphere is forcing villagers to migrate from the countryside to the cities, or more successful in economic and socially regions. Analysis of development of agrarian sector in the rural areas of Russia's Permskii Krai shows that sustainable rural development cannot be achieved only through the development of production. Changes are needed in both the economic system and in the system of social relations and relations in agricultural production and in the lives of citizens in the rural areas. The necessity to use effective forms of social and economic relations in the rural areas, by state regulation, municipal mechanisms of regulation and management, and regulation by non-State actors as well is justified in the paper. Types of socio-economic relations normative, organizational, managerial, land and property, production, labour migration, social, infrastructure are reviewed. The authors propose the implementation mechanism of a set of effective forms of social and economic changes for rural areas. Effectiveness of forms of social and economic relations is determined by the higher living standards and infrastructure to ensure rural territories, increased production of agricultural organizations.

Keywords: rural areas, effectiveness of forms of economic relations, social relations, infrastructural provision.

Protected areas protection and tourism management models as a basis for their sustainable development

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Abstract

Tourism in protected areas depends largely on preserved natural and cultural resources. Increasingly, the protection and preservation of these resources finds support in their valorisation at tourism market, thus creating a symbiotic relationship. Also, in order to make the tourism destination successful, two aspects need to be met - competitiveness and sustainability. Among the phenomena that characterize modern tourism, there are increasingly environmentally conscious consumers. Therefore, applying sustainability principles in protected areas tourism is the basis for achieving destination competitiveness. However, protected areas as specific tourism destinations in which this symbiotic relationship governs must constantly find models of tourism management that aligned with protected area management models. The main issue that protected areas tourism planning has to answer is how much impact is acceptable taking numerous factors into account. The paper, based on relevant theoretical principles, encompasses a comparative overview of literature (scientific papers, books, protected area management plans) dealing with issues of protection and protected areas tourism management worldwide, as well as an inventory and cross-analysis of models, approaches, strategies and tools used for this purpose. Their grouping was carried out according to protected areas characteristics, different approaches to protected area tourism development, as well as to management plan focus for the given protected area. The genesis of models, strategies and tools, and their interrelatedness were investigated. Their mutual conditionality was examined in order to improve or adapt certain models to the characteristics and needs of specific protected areas. Conclusions were drawn on which models can be used for specific situations and that, in order to respect the specificity of each protected area, simultaneous application of different complementary models and approaches may be desirable, including the development of situation-specific custom models and approaches to the protection and management of protected area tourism.

Key words: protected areas, tourism, management models

Satisfaction of hotel workers as a component of business quality improvement: A report from rural areas of Serbia

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Abstract

Satisfaction with the business is the current topic of global research, as one of the most important factors in the successful and quality business in tourist companies. The results of these surveys confirm that customer satisfaction and company profit can only be achieved through a quality service provided by satisfied employees. The authors of the research carried out research in accommodation in rural areas in Serbia in the period from March to May 2017, in order to examine the level of satisfaction of employees in these tourist accommodations. The results that the authors have come up with by survey research undoubtedly indicate that there are segments in the business that the employees are really dissatisfied with, and that education does not have much connection with the chance of changing the job. Research is just a part of the entire research and aims at pointing out the employees' attitudes about working conditions and improving the quality of services.

Key words: employees, accommodations, quality, satisfaction, rural Serbia.

Consumer perception towards Indira Canteen: A Study in Bengaluru, India

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Abstract

Food security has been a matter of concern in due to the global food crisis and rising food prices. For the urban poor, access to food is low due to high unorganized or informal sector employment which fetches low as well as irregular income. A major concern of any Government today is to avert deprivation and find some sustainable livelihood opportunities for the most neglected sections of the society. Government of Karnataka introduced Indira canteens, a chain of Fast food joints for the urban poor to mitigate food insecurity in Bengaluru managed by BBMP. Our sample size consist of 30 respondents at different Indira canteen of which 66.66 per cent of respondents are at the age of 26 - 40 and more than 66.00 per cent are male respondents. Majority of the of the respondents (90 per cent) are educated at below metric level and 96.66 per cent of respondents are working in unorganised sector's like street vendors, taxi drivers, daily labours, construction workers and security guards. Two out of every three respondents have monthly income of less than Rs.10000. 76.67 per cent of the respondents opined that the food supplying is of sufficient quantity to eat at the Indira canteens. And also majority of the respondents (28/30) opined that the food supplying is of above average and good quality. Two out of every three respondents visit Indira canteens daily for their food need. Average daily savings due to setting up of Indira canteen 78.66 per cent over the previous expenditure of food security and of which 66.66 per cent of the saved money is being utilized for spending on sufficient quantities of fruits, vegetables and milk, which will improve the food and nutritional security. Remaining saved money is being utilized for medical, education and other needs, which would improve the socio - economic status of the urban poor. Key words: Food security, Indira canteen, unorganised sector, saving, nutritional security and urban poor.

Key words: Consumer perception, food security, Indira canteen, food prices, nutritional security, India

Agriculture from statistical angle

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Abstract

The statistics of agriculture represent or cover a set of different topics such as: - information about the structure of farms, orchards & vineyards; - agricultural production; - economic accounts for agriculture;

- agriculture and environment. In order to present all the data on agriculture produced by official statistics, it would take a lot of time and paper space. The aim of this paper is to present Montenegrin agriculture through data on the structure of agricultural holdings collected by the Agricultural Census 2010 and the Farm Structure Survey 2016 at the Statistical Office of Montenegro-MONSTAT. Bearing in mind that the structure of agriculture in the Member States of the European Union varies as a function of differences in geology, topography, climate and natural resources, as well as the diversity of regional activities, infrastructure and social customs, the structure of agriculture in Montenegro is also conditioned by these parameters. This paper will present some statistics from the most recent Farm Structure Survey that was conducted in 2016 and in several cases compares these with results from the Agricultural Census in 2010.

Keywords: statistics; agriculture; structure; holding; census.

Changes in the size of the population of the Montenegrin villages from the second half of the twentieth century

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Abstract

This paper describes the changes in the size of population of the Montenegrin villages at the national level, regions and municipalities that have arisen as a result of rapid industrialization, urbanization and deagrarization from the second half of the twentieth century. These processes had initiated migration, which had the highest intensity on village-city relation, which has led to demographic fragmentation and sanitization of the Montenegrin villages, so now, at the beginning of the third millennium, we have 39 villages without residents, as well as a significant number of them which are almost in the state of demographic extinction.

Key words: village, size of population, industrialization, urbanization, deagrarization.

Innovations and Methods for Rural Tourism Development

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Abstract

Tourism as a new industry has had a major impact on the economic, social and cultural situation of the world in recent years. Creating employment, valuing, helping global peace, paying attention to investing in cultural heritage, developing rural areas with potential for tourism, immigration control, cultural development is among the benefits of this industry. In many of these countries, the dynamic tourism industry is considered as the main source of income, employment, private sector growth and infrastructure development. Traveling to rural areas Traveling people to rural areas to have fun or watching these places is one of the major characteristics of such trips or experiences that people experience in a completely different environment and see that people's lifestyles The extent to which living places are different is different from living in today's cities. A trip or visit to visit rural areas or with a cultural or incidental purpose is considered as part of the industry, which guarantees the survival and stability of the industry in the future. In terms of spending time and time, both time and space are considered as two criteria. The time-limit determines the length of time a person can use to spend his or her leisure, when appropriate. This research is conducted by analytical and field research methodology to study the strengths and weaknesses of rural tourism and also provide innovations such as predicting the construction of indoor glass halls with appropriate tourist facilities (tourism incubator), the use of natural materials for climatic integration in housing Indigenous urban and rural communities, the use of modern airway technology, provincial zoning in terms of the role of the climate in tourism development, etc. will be required.

Key words: Tourism, Village, Rural Tourism, Innovation

Assessment of Agricultural Support to Producers in Bosnia and Herzegovina

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Abstract

The previous analysis of support to agriculture in Bosnia and Herzegovina (BiH) implied only budgetary transfers without taking account of the support originating from market-price policy measures. The purpose of this paper was to provide, for the first time, an estimate of the total support to the agricultural sector in BiH as well as the level of protection of producers through the price of agricultural products. This estimate was done using relative support indicators (Ag incentives, Erjavec, OECD), Total transfers to producers (TTP), Nominal rate of protection (NRP) and Nominal rate of assistance (NRA). The computation of these indicators for Bosnia and Herzegovina was done using the original method (Erjavec et al, 2017) suitable for use in countries with underdeveloped agricultural statistics. Percental TTP represents the share of total budget and market-price support to agriculture in the total value of agricultural production, while NRP and NRA indicators show the level of protection of producers through domestic prices of agricultural products. The NRP is defined as the percentage ratio between domestic market price and the reference one, while the NRA represents the difference between gross revenue of agricultural producers calculated based on domestic prices and gross revenue calculated based on reference prices. In this paper, EU reference prices were used for comparison with BiH domestic prices. The results of the research have shown that there is a difference between BiH and EU reference prices indicating the significant protection of BiH agricultural producers which according to the NRP averages 9%. On the other hand, the comparison of agricultural producers' revenues calculated based on BiH prices and revenues calculated based on EU reference prices shows a significantly lower total support – by approximately 4%.

Keywords: support, indicator, Bosnia and Herzegovina, reference price, domestic price

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The current development level of sustainable rural tourism in Montenegro

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Abstract

The notion of sustainable rural tourism gains importance towards the end of the 20th century, as it advocates the type of tourism that minimally influences the environment and local culture. Its main goal is to enable tourists to gain knowledge on the natural, historical and cultural characteristics of a unique environment while simultaneously preserving the local integrity and encouraging economic growth and benefits of local community. When it comes to Montenegro, as a small European country with features of both coastal and mountainous regions, it must be first seen in the context of the very concept of sustainability and the idea of energy efficiency, the usage of renewable resources and the preservation of the overall natural environment. However, in spite of its preserved environment and socio-cultural and historical diversity, Montenegro's rural areas are still highly underdeveloped. The main objective of this research was to define key factors of development level of sustainable rural tourism in Montenegro, based on a PESTEL analysis and on overview of domestic and foreign literature. Considering natural, geographical, historical and socio-cultural characteristics of Montenegro, the conclusion indicates that Montenegro, despite of existing strategies and legal documents, has not yet successfully implemented the concept of sustainable rural tourism. The success of development of sustainable rural tourism depends largely on the level of collaboration between the key players in the rural areas, and especially among the all stakeholders on regional and national level.

Keywords: sustainable rural tourism, rural development, Montenegro, PESTEL analysis

Opportunities to profit under competitive market conditions: The case of the Macedonian wineries

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Abstract

Building a recognizable brand for the high-quality bottled wines from the RM is the core to a strengthened international market position. This paper attempts to identify the opportunities to profit under competitive market condition of the Macedonian wine sub-sector. For this reason, we first interpret evidence on structural determinants of Macedonian wineries' profitability, then we interpret evidence on the existing marketing strategies of the Macedonian wineries, and finally we present successful case study of a winery that have succeeded to create a recognized brand internationally. The results from this analysis suggest definition of a successful winery that exhibits increasing opportunities to profit under competitive market conditions. The defined winery may be used as a guideline to reinforce possibilities for Macedonian wineries to be able to follow future market signals, considering that they still struggle to adjust to the imposed market oriented production.

Keywords: profitability strategy, marketing strategy, brand creation, competitive position.

Payments for ecosystem services and stakeholder's perspectives in Serbia

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Abstract

Payments for environmental services (PES) have attracted increasing interest as a mechanism to translate non-market values of the environment, into real financial incentives for local actors to provide environmental services (ES). The PES concept is relatively new to Serbia. It has not been developed and implemented. However, recent laws regulating the use of natural resources have enabled some basic environmental economics mechanisms. The current Environmental Protection Act in Serbia adopted the "user pays" principle and introduced fees for the use of natural resources and some ecological services. Other laws, such as the Water Act and the Forest Act, also regulate payments for the use of natural resources. Two ministries share the responsibility of water management in Serbia: the Ministry of the Environment, Mining and Spatial Planning (MEMSP) and the Ministry of Trade, Agriculture, Water Management and Forestry (MTAWMF). In general, MEMSP is responsible for water pollution issues, while MTAWMF is responsible for water use, flood prevention and for other technical aspects of water management. Certain responsibilities are shared at the provincial or local level. Fund for Water is not an institution, but a separate budget item in the national budget. It was established in 2010 by the Law on Waters. Six types of charges go into the Fund for Water. They are: charge for use of water resource; charge for water discharge; charge for pollution of water; charge for drainage; charge for use of public water, facilities and systems; charge for basin water management. The first three charges are fees for economic instruments related to water protection; the remaining three are water management charges. Financial plan for water management activities for 2011. shows that the highest financial part is directed to: management of water courses and flood control (32,93%). Some of the important characteristics of a PES schemes that are generally absent in existing financial mechanisms in Serbia are: explicit internalization of environmental costs; transparent pricing system; clear indications of purpose of charges; control of use of generated income (it should be mainly used for improvement of the state of the ecosystems); monitoring the efficiency of financed conservational measures.

Keywords: PES; stakeholders; Serbia.

“A woman selling apples”

Rural development and some tips for marketing strategy

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Abstract

Macedonia is an agrarian country that is thankful for the fact that it has favorable natural conditions (climate and soil) and produces a wide assortment of fruit and other agricultural products. Fruit production as an integral part of the agro-industrial complex in the country plays an important role in the development of the overall economy of the country, but also in trade with the world.

Macedonia is known for its apple production in the region, which dominates the total fruit production (about 60% of fruit production in the country) and is mainly table fruit.

The marginal presence of Macedonian apples in the world markets imposes the need for an organized approach, and for strategic and planned operations.

Women are the backbone of the development of rural and national economies. They comprise 43% of the world's agricultural labor force, which rises to 70% in some countries.

In Africa, 80% of the agricultural production comes from small farmers, who are mostly rural women.

Women comprise the largest percentage of the workforce in the agricultural sector. Taking example from them we will try to involve woman in selling apples.

The aim of the research is to analyze marketing strategy / strategies to increase consumption of apples in the domestic market.

In order to apply appropriate methods of work and data analysis obtained/gathered through: the method of analysis, the comparative method, statistical method and interview.

The situation will be better and positively evaluated only if in the future, an intense promotional campaign that declares the apple as a strategic product in the country, led by woman. This will help to maintain existing markets and to introduce new varieties of apples in the retail market.

Keywords: woman, apples, strategy, brand promotion.

Establishment and development of credit cooperatives in Bulgaria

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Abstract

The article analyses the experience of credit cooperatives in agriculture and forestry in Bulgaria and the development of legislation in this area. It was found that due to the small size of individual plots and their dispersion in the region of the lands of the settlements it is not possible an effective management of these properties. These factors appear as a reason for difficulty in financing from the programs for rural development by the European Union. Credit conditions by commercial banks are unprofitable and difficult to implement, and interest rates are too high, which is why for small and medium-sized forest and agricultural landowners one of the possibilities for short-term loans at preferential conditions is credit cooperatives.

A well-developed system of credit cooperatives is in the countries of Western Europe and the US. Founders of this type of cooperatives are the activists of the German cooperative bank - Raiffeisen – for local credit banks and Schulze – for popular regional banks. For more than century-old history credit cooperatives in many countries hold a significant portion of their financial-credit system, directly serving private agricultural and forestry producers.

Bulgaria was a country with a well-developed market-oriented cooperative sector. The credit cooperatives have been prevalent in this sector. Over the years the importance of cooperatives, including credit cooperatives, not reduced, but changed conditions in the period of planned economy led to the decreasing of their number and to the disappearing of credit cooperatives in Bulgaria. After the changes occurred in the country (restoration of property on the lands and forests and the emergence of many and small owners without the necessary financial resources and skills to manage them) arises the need to restore the credit cooperatives.

The purpose of the creation of credit cooperatives is to assist private forest and agricultural landowners to have care for them, to assist in the expansion and strengthening of their farms, to increase the quality of life and to improve the local economy.

There are made proposals to create conditions for development of the credit cooperatives in the country and are referred the positive results expected from the creation of credit cooperatives.

Key words: credit cooperatives, agriculture, forestry, cooperative legislation.

Comparative analysis of the organic food market in the Republic of Serbia and Neighbouring Countries

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Abstract

The aim of the paper is to analyze the current state and the achieved development of food production in the organic production system in the Republic of Serbia and the neighbouring countries. The Republic of Serbia and the countries of the region have significant potential for organic food production, which is in particular because of favourable climatic conditions. The comparative analysis includes the analysis of areas under organic plant production, the number of organic producers and the development of the organic food market. Starting from the fact that organic production is still not sufficiently represented in the countries of the region, the aim of this research is to look at the prospects for organic agricultural production, as well as the appropriate measures that should intensify this type of production in the Republic of Serbia and the countries of the region.

Keywords: Organic production, Republic of Serbia, countries of the region.

Tourism and Rural Development

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Abstract

Rural development policy emphasizes the importance of neutralizing the infrastructure and economic differences that exist in social and cultural aspects of life between the centers and peripheral regions. Rural development can be stimulated through the improvement of various mechanisms to facilitate coordination of agricultural development activities with other economic and non-economic activities in rural areas, with the ultimate goal to increase the living standards of local people.

Tourism is one of most increasing economic activity in the world with participation in gross domestic product with around 10%; over 7% of total world exports and about 30% of world trade in services are gained through tourism. Statistics also shows that only in 2017 a total of 1,326 million international tourist arrivals were recorded in destinations around the world, some 86 million more than in 2016 which is increase for 7%. Following this positive trend recorded in international tourist arrivals, international tourism receipts increased 4.9% in real terms to reach US\$ 1,340 billion.

After analysis the concept of sustainable development and the changes in the contemporary environment, authors have noticed that the most interesting destinations for modern tourists are rural tourism destinations with untouched nature and specific anthropogenic values.

Based on these figures and facts, the basic assumption of the paper is that tourism can play an important role in preserving and promoting rural destinations and fostering rural development. Starting from this assumption, the basic aim of paper is to underline the necessity of a new concept of rural tourism implementation in order to ensure sustainable rural development.

The authors critically discuss the risks of the current unsustainable tourism development and suggest possible principles of the new concept of sustainable tourism and rural development. Research was conducted using the contemporary national and international relevant sources and appropriate qualitative methodologies.

Key words: rural areas (destinations), tourism, sustainable development, rural development.

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Analysis of the rural infrastructure and sustainable development of the rural area of the Municipality of Pljevlja

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Abstract

Infrastructural systems are complementary systems that create a unique entity for living in a region! Rural area of the Municipality of Pljevlja. It is situated in the northern mountainous area in Montenegro. Geographical position, relief, climate, waters and land represent the natural and geographical features of this area. Their analysis shows a place with a well-shaped relief, complex landscapes containing a lot of contrasts, historically, socially and geographically unique. The paper considers migratory processes in the rural area as well as the historical development all up to today. Infrastructural problems in each local community are thoroughly analyzed. Suggestions for further development and improvement of living standard are given here with the aim to stop migratory processes. It is also necessary to protect natural resources and work on sustainable development. The research results confirmed the main hypothesis and all sub-hypothesis that are common for all the Montenegrin rural areas.

Key words: Infrastructural systems, natural and geographical features, rural area of Pljevlja.

(7) Rural Environments and Architecture

The Aspect of Health as a Key Indicator for Rural Sustainability

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Abstract

Nowadays the rural environment is struggling for its survival. In present conditions, the sustainability of rural environments is uncertain and questionable, and this negative phenomenon is recognized all over the globe. Inadequate spatial and developmental policies, and the lack of these, have led to a process of deruralization, accompanied by the process of uncontrolled urbanization, which together are the cause of numerous negative consequences that this massive spatial reordering has on people. This situation needs to change with the new development policy that takes into account economic, environmental and social aspects of sustainable development. But besides many current problems with which rural environments are struggling with, there are also a lot of benefits that make them a desirable place to live. This work focuses on health benefits and argues that rural settlements have better effect on human health in comparison with the urban areas. By reviewing and benchmarking the research that deals with the characteristics of rural environments that affect human health, the work lists determinants concerning the impact of a rural area on human health and then compares selected examples of rural and urban areas. Besides proving the accuracy of the initial hypothesis, the results of the work aim to raise the relevance of the aspect of health when it comes to decisioning about moving from a rural to an urban area. Furthermore, the relevance of a healthy place could be narrowly connected with the sustainability of rural environments and may, as such, become an efficient tool for policy sector and other actors who are able to promote and preserve life in rural settlements. This is recognized as one of the main goals of sustainable development globally, under the precondition that the quality of life in rural areas is not lagging behind the life in cities.

Keywords: case examples; criteria; human health; rural environment; sustainable development.

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Identification of regenerative examples of agricultural urban and architectural design and mapping potential sites for implementation on the example of Podgorica

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Abstract

Background: The intense urban growth of many cities in the world and the parallel processes of urban regeneration indicate the increasingly important role and complexity of the spatial and physical aspect of regeneration, where through the urban images and architectural interventions the current city image can significantly be improved. In modern researches, urban agriculture is recognized as a concept of sustainable development with many advantages. Purpose of this paper is to point out the role of integrating sustainable agricultural models into urban farming master plans and architectural projects into the context of contemporary regenerative urban processes.

Methods: In the research, the identification of some successful regenerative examples of the practice in agricultural urban design and architecture was first performed and followed by the mapping of potential sites for implementation of agriculture urban models. These models would further be treated through formal planning documents, and finally, through spatial realization.

Results: The results of the research indicate the current status and presence of integration of various agricultural models into urban and architectural plans and projects in the context of the regeneration of the many world cities. At the same time, it has been established that there are a number of limitations at the moment of formalizing the plan and implementation of the proposed solutions in practice. Several zones are identified, positioned dotted in the narrower and wider zone of Podgorica, which could be used as a platform for the implementation of different, sustainable models of urban agriculture in the urban planning process and the process of regenerating the city. At the same time, these acupunctural places of interventions could be used to develop a network of agricultural content at the city level.

Conclusions: The research identifies regenerative examples in the practice of agricultural urban planning and architectural design and it was concluded that there is a real basis for the implementation of similar models in the area of Podgorica.

Keywords: agricultural urban design; regeneration; mapping, Podgorica

Evaluation of constructions with a traditional architecture located in Transylvania, Romania

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Abstract

The real estate valuation process is a systematic procedure usually followed by a person with the necessary training to answer questions about the market value (in most cases) of a real estate property. The context of this paper consists in the realization of a point of view regarding the real estate valuation of a building with a traditional architecture, a historical monument from Transylvania, Romania. A historic monument is a sculpture or architectural construction of great proportions or of great value designed to perpetuate the memory of an event or a remarkable personality. In the first part of the article was analyzed and presented the traditional architecture of the subject construction and also was presented the unique architectural aspects of the area. The evaluation of the traditional architecture construction was done by applying the market approach. In the first phase, market analysis for this type of property was carried out at national level, then at a local level. After analyzing the Romanian market, other specific markets in the neighboring countries were analyzed too. Thus, the market approach was applied using comparable properties from Romania, and then from other neighboring countries. This was possible due to the unique characteristics of the analyzed constructions, and the market area was considerably broadened. Thus, the market value for the traditional architecture construction was obtained through the two mentioned methods and a comparative table was made between the two methods used. For additional control, the cost approach was applied to determine the market value of the building declared historical monument. The evaluation of a construction with traditional architecture is a challenge for the specialists in the field and the analysis has been carried out on an extended geographic area.

Keywords: traditional architecture, building evaluation, Transylvania.

Particularities of Budva's tourist traffic in the XXI century and its further tendencies

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Abstract

This municipality covers a space of about 122 km², with a total length of about 27 km (of which the length of the sea coast is about 22 km) and a variable width ranging from 3.5 to 9 km. Budva covers only 0.88 percent of the total territory of Montenegro. The natural and geographical characteristics of the Budva coastline make an invaluable landscape diversity of diverse benefits and motives of fundamental importance for its socio-economic, and primarily for quality and sustainable tourism development. The main economic activities in the municipality of Budva are tourism and catering. Budva has 35% of accommodation capacities compared to Montenegro. A slight growth of accommodation units can be noted by some 3%. This growth is most reflected in private accommodation, which shows that Budva is oriented towards more mass tourism. The number of arrivals in Budva has a trend of growth, but we can also say that most of the tourist traffic is done during the four busiest months. Budva participates with 45% in 2015, 47% in 2016 and 43% in 2017 in overnight stays in the coastal region and thus dominates in comparison to other municipalities in the coastal region. Further development initiatives should go towards development of the rural – agro tourism in the inland, using comparative advantages of the climate, physical-geographical characteristics, but also traditional rural infrastructure that characterize Mediterranean Region.

Key words: potentials, traffic, accommodation units, tourism, rural – agro tourism.

Potential of tourism development in the Niksic municipality, Montenegro

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Abstract

An analysis of the potentials of the municipality of Nikšić with all elements of a natural resources, which can be used for the purpose of its tourist valorization, has been carried out. The natural basis for tourism development is analyzed through natural geographic factors, geological and geomorphological characteristics, basic climatic features, hydrographic characteristics, flora and fauna. It was noticed that these factors influence the spatial planning and development of tourism in this municipality. The cultural basis for the development of tourism has been analyzed using historical method. Events from the past recorded many traces of those times in the form of archaeological sites, historical monuments, monasteries and churches. All these cultural-historical potentials with the specific rural architecture, together with ethnographic motifs and manifestations, give a special signature to the tourist value of Niksic's municipality. It was concluded that the geographic space, human resources and material basis are the three basic elements that may be the engine of the tourism development Niksic municipality.

Key words: space, relief, sustainable development, tourism, rural – agro tourism.

Determinations of rural area: Review of the criteria and indicators for defining rural areas

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Abstract

The emphasis of this paper is on defining urban and rural areas, as well as determining the boundary between them, with particular emphasis on contemporary European methods that are applied in defining these areas. The actualization of the issue of relations and definitions of urban and rural areas has been especially emphasized after considering towns and villages through normative documents, and by more and more frequent dealing with sustainable development of spatial planning, social development, agrarization and others. Industrial transformation and urbanization had a major impact on the transformation of these spaces. The joint actions of these two factors have begun the processes of migration and deagrarization. The distribution of population, activity and capital in these processes has been substantially changed and conditioned by spatial changes. New spaces of various sizes have been created, ranging from groups of several houses to the size of megalopolises. Hence, the impetus for this research is the division of space into urban and rural areas sufficiently adequate to cover all the changes taking place in the area. This paper aims to showcase a number of methodological approaches such as: OECD (Organisation for Economic Cooperation and Development), A revised urban rural typology, DEGUBRA (Degree of urbanization) and document "Future of rural society". Each of the aforementioned methodologies used different criteria for determining and defining rural and urban spaces, each of which had the advantages and constraints that led to the addition of previous or the creation of new methodologies. Finding the definition, the problem of placing it, and (im)possibility of creating a universal modern rural model are the key issues of this research.

Keywords: classification of rural areas, definition of rural areas, rural model

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Organization of sustainable agricultural land utilization and its rational use within the borders of rural settlements

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Abstract

The result of the political and economic processes taking place for the past 25 years, not only in Russia but also in many countries of the CIS and Eastern Europe, is the transformation of agricultural land use. It is not only the change of ownership, but also the alteration of borders of agricultural enterprises (collective farms, cooperatives, etc.), the formation of new land plots, violation of the integrity of arable lands. There is no doubt that mass redistribution creates many problems in the organization and rationalization of the territory, agricultural production, social development of rural settlements. Organization of agricultural land use is one of the priority tasks of development of rural territories. During the implementation of land reform programmes, all transformations within the boundaries of rural settlements were conducted without proper planning. That resulted in a number of spatial, organizational problems in the use of agricultural land. Part of the agricultural land ceases to be treated, overgrown by forest, weeds. The paper reveals major flaws and problems of agricultural land use, discusses the ways to eliminate them, raised the question about the need for an inventory of agricultural land, and justifies the economic effect of involvement in trafficking of arable land overgrown with forest and scrub. The authors propose a methodology of formation of investment sites for involving unclaimed and abandoned land into circulation and prove the need to develop schemes for organization of use of agricultural land in the territory of rural settlements.

Key words: rural settlements, land utilization transformation, territory organization, land use

Protection of Built Heritage in Rural Areas of Šar Mountain

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Abstract

This work studies unique architectural ensembles located within the rural areas of Šar Mountain, their historical, architectural and artistic values, and therefore the touristic potential as well. In situ recordings and measurements, together with the collection and the analysis of archival, historical and other published material are fundamental research methods in this work, based on which the valorization and the scientific description of values of collected and studied case examples have been done. The existing state of studied ensembles, as given in the paper, clearly indicates a necessity of protection from further devastation, in accordance with the specificities of current economic and socio-cultural conditions, and contemporary trends in protection of architectural heritage and development of rural areas. The program of protection of unique, small, traditional rural communities on Šar Mountain, besides the architectural measures, should include economic and legal solutions of their status to ensure the sustainability of not only recognized cultural values but also of life in general, based on long tradition of a specific social organization both on micro and mini-regional spatial levels. For centuries, the cultivated model of religious and ethnic distribution and diversity in space has represented a richness that is, inter alia, reflected in architectural composition of rural entities of Šar Mountain, some of which were studied in this paper. As a final result, the work aims to expand the list of architectural built heritage in Šar Mountain, and, wider, in Kosovo and Metohija, in accordance with the criteria of heritage valuation prescribed by the UNESCO. In addition to traditional residential rural cores, there also exist other valuable man-made structures on Šar Mountain, such as necropolises, monastery complexes, fortresses, bridges and other objects of cultural-historical significance that require profound studies and actions towards preservation of their authenticity, integrity and quality.

Keywords: architecture; development; heritage; protection; rural area.

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Perception of the student population in relation to the rearranging and improving the enrolment policies: Case studies Niksic (MNE) and Ljubljana (SLO)

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Abstract

The aim of the research was to determine the perception of the student population in order to potentially rearrange and improve the enrolment policies. The obtained data were statistically processed by HB (Hierarchical Bayes estimation) with the preferred choices, i.e. how many times each item (17 identical questions for both groups of students) was selected and ranked within the sets. Out of several analysis for this report we used data obtained in communication with Pedagogical Studies Students from Niksic (MNE) and Ljubljana (SLO). The students highly ranked the quality factors of teaching performance when during the studies; the lecturers are described as experienced practitioners, exercises and lectures are based on case analysis and that there is a lot of practice in education programs. It is somewhat surprising that the analysis results shown that innovative and individual educational approaches are of less importance for enrolment. However, it turned out that access to the faculty and the vicinity of the faculty to their home do not have a significant weight in deciding students for the choice of faculty. In addition, questions arise about the geographic position of the location of faculties: Very urban or Mountainous North parts of both Countries. Options not to be placed in the Regional urban centres but to be placed towards the Mountainous, to some extent rural areas, were discussed. The offer included all the needed modern facilities to be included. Although, it is emphasized that the geographic position of the faculty was not considered as important, this rings a bell that some future strategies for the Countries Regional / Rural development may take into consideration this fact, preparing analysis on the establishment of academic centres not necessarily placing them in the urban epicentres. If we would like to increase better geographical distribution of study programs, then the focus should be given to the quality factors and public character of faculty because they are dominant at enrolment.

Keywords: students; academic institutions; micromanagement; perception; facility geographic position.

Land degradation caused by illegal construction in the Bjelopavlici Plain: Case study of the narrow belt along the motorway Podgorica – Danilovgrad, Montenegro

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Abstract

Montenegro is a hilly and mountainous country. Fertile plains around the rivers and coastal floodplains of Montenegro are densely populated, much more than the other parts of the country. That is the case with Bjelopavlici Plain, with rich potential for agricultural practices and suitable climate. Agricultural and commercial potential have attracted people to this area, and has caused rapid spatial expansion between the cities Podgorica and Danilovgrad, and the urban sprawls over fertile agricultural lands along the floodplain. National legislation loopholes and technological improvement were the cause of the commonly unsupervised human encroachment which caused the widespread degradation of the landscape. We studied as a specific case the region of the narrow belt along the motorway Podgorica – Danilovgrad in Montenegro where the pressure of migration increased on the beginning of this century. This was especially intensified with the increased commercial activity after the establishment of the commercial zone along the narrow belt of the motorway. Municipality of Danilovgrad has offered, as a stimulant to the industry, the use of land next to the road belt 100 meters along the main road without taxes. In principle, the decision turned agriculture into the urban land. As a consequence industrial hall, furniture salons, customs warehouses were built along the road. Reversed use of land from agricultural to urban construction land was not followed by legal provisions. This decision was not in accordance with the Spatial Plan of Montenegro (1986) and the Development Plan (2008). Unplanned, uncontrolled and illegal urbanization process has been causing degradation of agricultural areas. In this study, the narrow belt along the motorway Podgorica – Danilovgrad is examined in different ways: we analyzed land use changes, urbanization, geomorphology, some directions for suitable urbanization were provided. A comprehensive analysis of the increased pressure due to expansive economic and urban development is presented with the aim of evaluating changes in land use and their deleterious effects on the area relief forms. These seriously vulnerable zones that have caused degradation in the quality of the eco-environment should be treated with best management practices for eco-environmental rehabilitation.

Keywords: Land use changes, illegal construction, agricultural land, land degradation

Research and implementation of good agricultural practices for traditional agricultural production in Orja Luka, Danilovgrad, Montenegro

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Abstract

Many rural areas in Montenegro are undergoing significant ecological and socioeconomic transformations. Agricultural development of small settlements should be one of primary goals of all the agricultural, rural development and environmental management strategies, employed to make full use of labor that now remain in the rural areas of Montenegro. The promotion of traditional foods may be a tool for coping with modernization trends in transition economies. The ecological and economic consequences of this development will affect small number of people that remain there in the rural areas, but will decrease the trends of migration from there to the cities and keep the organization of the landscape as it is now. We studied possibilities of implementation of good agricultural practices for traditional agricultural production in Orja Luka, Danilovgrad, Montenegro. Orja Luka was in the earlier periods the settlement with strategic position between the towns of Danilovgrad and Niksic established on a hill and dominated the plain area of this Region. For this micro location we recommend organization of Pomegranate growing as the main agricultural product with the idea to slightly increase employment in this sub region of Bjelopavici plain. This was based on the fact that the production of pomegranate juice and related products has long been used in this region, either in traditional medicine or as nutritional supplements claiming beneficial effects (significant protective effects, polyphenol-rich fruit juice with high antioxidant capacity: antiatherogenic, antioxidant, antihypertensive, and anti-inflammatory effects). This product was quoted in all the countries of the Region as a common traditional product. In this research we describes the challenges of living in this rural part of Montenegro, and how pomegranate growing and its juice processing have made the best use of available resources, providing an interim solution while waiting for more comprehensive national systems to become a reality. Experience with the other regions in Montenegro has indicated that the best chances of success in establishing such a program is the inclusion of in-country "champions" to provide the leadership, energy, and direction to build the program. That lessons learnt we recommended also here. With this intervention, out of economic benefits, the studied area will additionally be decorated, that will create a new added value. By cultivating this plant on the slopes of the settlement we will preserve the traditional landscape. Aesthetic enhancement of this space will be achieved. The location, which is in the middle of the Mediterranean and Alpine tourist centers of Montenegro, should become an attractive offer to tourists who would use this position as a holiday destination when traveling through Montenegro. Furthermore, we concluded that marketing efforts are needed to allow farmers to better exploit value chains in date thereby reaping higher benefits from improved market access to secure their often marginal income.

Keywords: Traditional agricultural products, rural development,

Lithuanian flora plants in flower gardens of Lithuanian villages

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Abstract

It is believed that flower gardens in Lithuanian villages were established in 14th-15th centuries by copying flower gardens from manor and monasteries. Introduced plants got into these flower gardens also from manor and monasteries. Scientist's opinion about wild local floras plants in flower gardens differs. Some of them thinks that wild plants were not planted in the flower gardens for some time because these plants grew in the near surrounding and people could have just picked them from there. Other say that wild decorative, medicinal plants and herbs were planted in the flower gardens from the beginning of 2016-2018 plants from village's flower gardens were inventoried in South Lithuania. We noticed that part of these plants belongs to Lithuanian flora plants. Some species of wild Lithuanian plants grow in flower gardens for a long time now and are ethnographic old flower gardens plants. In South Lithuanian flower gardens, we found these considerably ethnographic plants: *Convallaria majalis* L., *Polygonatum odoratum* (Mill.) Druce, *Artemisia absinthium* L., *Jovibarba globifera* (L.) J. Parn., *Mentha* spp., *Leucanthemum vulgare* Lam., *Thymus serpyllum* L., *Polemonium caeruleum* L., *Viola tricolor* L., *Hylotelephium maximum* (L.) Holub, *Viburnum opulus* L., *Primula* spp., *Aquilegia vulgaris* L., *Sambucus nigra* L., *Sedum acre* L., *Symphytum officinale* L., *Tulipa sylvestris* L. Other wild plants were grown in flower gardens later. Some of these plants are moved from their natural settlements or their seeds are sown. Others just grow up by themselves in flower gardens and are being left there to grow. In current villages flower gardens 38 species Lithuanian floras decorative, medicinal plants and herbs were detected.

Key words: Lithuanian flora plants, traditional plants, flower garden.

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**(8) Environment protection
and natural resources management**

Soil erosion modelling in the mountainous watersheds of Nepal

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Abstract

Soil erosion is a serious problem in Nepal given that the country is mountainous with undulating topography with steeper slopes. This study calculated the soil erosion rates using three different approaches in three different sites of Western Nepal. The first one employed Revised Universal Soil Loss Equation (RUSLE) along with Geographic Information System (GIS) to calculate the soil erosion rates in the Aringale Khola watershed. The second approach looked at the impact of long term land use land cover changes on soil erosion dynamics in Sarada, Rapti and Thuli Bheri river basins using GIS, RUSLE and Remote Sensing (RS). The third one used computer graphic IntErO model to calculate the sediment yield from the Sarada river basin. Average soil loss in the Aringale Khola watershed was found to be 11.17 t/ha/year. With the increase in agriculture and built up area and the decrease in forest and water bodies, mean soil erosion rates in the Sarada, Rapti and Thuli Bheri river basins increased continuously through the years; rates being 5.35, 5.47 and 6.03 t/ha/year in 1995, 2007 and 2015, respectively. IntErO model predicted gross soil rate of 1074.35 m³/km²/year equivalent to 8.59 t/ha/year in the Sarada river basin. A major part of the river basins, especially those on steep slopes are degraded and require urgent soil conservation measures. This also confirms the effectiveness of RUSLE and IntErO models in predicting soil erosion rates in degraded catchments and have very good potential to be used in other river basins of Nepal.

Key words: Conservation, GIS, remote sensing, river basin, RUSLE, IntErO

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Water erosion modelling of the Pedra Branca Stream Watershed, Southeast of Brazil

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Abstract

Under natural conditions, the landscape dynamic evolution process occurs at a metastable equilibrium, between morphogenesis and pedogenesis. However, the lack of adequate soil management increases erosion, which causes socio-economic and environmental damages. The study was conducted between November 2016 and September 2017 in the Pedra Branca Stream Watershed, Alfenas Municipality, Minas Gerais state, Brazilian Southeast. The Intensity of Erosion and Outflow software – IntErO (Spalevic, 2011), which has its algorithm based on the Erosion Potential Method (Gavrilovic, 1972), was used to estimate the total soil loss, the sediment yield and the sediment retention. The study area climate is humid subtropical with dry winter and hot summer with average annual temperature of 20° C and 1321 mm year⁻¹ of rainfall. The mean basin slope is 10.19% and the soil is classified as Dystrophic Red Latosol, in Brazilian classification. Regarding land cover, 44% of the area is composed by well-constituted or degraded forests, 43% by mountain pastures and orchards and vineyards, 9% by plough-lands and 1% by bare lands. By the relation of physical coefficients, as soil type (Y), land cover (Xa), visible signs of erosion (φ) and mean basin slope (Isr), is possible calculate the erosion coefficient (Z), in which the results show a Z average of 0.25, which corresponds to category of low erosive potential (IV), with total soil loss of 20316 m³ year⁻¹, 12% of coefficient of retention and sediment yield of 2518 m³ year⁻¹. The highest losses occurred in the devoid areas of vegetation cover, followed by annual and perennial crops, reaffirming the role of soil protection by vegetation. We concluded that the IntErO software could be used as a tool for the modeling of land losses in regional scale and watersheds (Batista et al, 2016; Spalevic et al, 2016; Barovic et al, 2015), with results consistent with other soil loss models, based in empirical equations, such as the Revised Universal Soil Loss Equation.

Keywords: Erosion Potential Method; IntErO; watershed management.

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Application of IntErO Model to Investigate the Effects of Land Use Changes on Soil Erosion and Sediment Yield in Talar Watershed, Northern Iran

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Abstract

The present study has been conducted to investigate the effects of land use change on soil erosion using Erosion Potential Method (EPM) embedded in the Intensity of Erosion and Outflow model (IntErO) through predicting flow peak, soil erosion and sediment yield under land use changes in Talar watershed in northern Iran. At the first, the required spatial maps including DEM, land use, soil, geology and stream network were prepared in GIS environment. The climatic data such as the volume of the torrent rain, average annual air temperature and average annual precipitation were calculated based on meteorological station data. The results of land use change within the period of 1991-2014 indicated that the forest area decreased by 12478.04 ha (6%) and the other land uses such as irrigated agriculture, rainfed agriculture, rangeland and residential area increased by 476.00, 7248.25, 4481.05 and 273.95 ha, respectively. Based on symmetry coefficient (0.31), the calculated maximum outflow was 432.14 m³ s⁻¹ (incidence of 100 years) which increased to 446.91 m³ s⁻¹ in 2014 and it can be clearly concluded that the possibility for large flood waves to happen in the Talar River has been increased. Also, the amount of production of erosion material in the river basin and real soil losses increased 265372 and 60938.9 m³ yr⁻¹, respectively. In general, the results showed that lack of appropriate land management and planning increases maximum flow rate and also sediment yield in the study area. The present study demonstrates the application of the IntErO model to understand the effect of land use change on hydrological behavior, soil erosion and sediment yield process and can be used as a useful tool for soil conservation research in watershed scale.

Keywords: EPM, Land management, Sediment yield, Soil erosion model, Talar watershed

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Quantification of intensity of soil erosion in the Komaracka River, Polimlje, Montenegro

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Abstract

The Polimlje area represents a geographical entity, which includes the Lim Valley on the territory of Montenegro, Serbia and Bosnia & Herzegovina. The river, from the source to the mouth of Lim in the Drina near Medjedje, is about 220 kilometres long. The Upper Polimlje, in which the studied area of Komaracka River is studied, includes a basin of the Upper Lim River and its surrounding mountains: Bjelasica (2139 m) and Visitor (2211 m) from the western, Prokletije (2694 m) from the south, Mokra and Cmiljevica (1984 m) on the east side. The steep slopes of these high mountains descend into the basin of the Plavsko-Gusinje basin, the Sućeska canyon, the Andrijevačka, Trebačko-Marsenička and Berane basins, which is closed by the Tifranska gorge.

Erosion processes and torrents caused strong land degradation in the Polimlja area. During the rainy periods, the fertile agricultural and forest lands are washed from the steep slopes of unprotected mountainous areas of the basins, thereby directly reducing the yields of agricultural production; On the other hand, the retention capacity of the soils decreases, which facilitates the formation of torrents and torrential flows.

The aim of this paper was to analyse the physical and geographical characteristics of the Komaraca River Basin, calculating the intensity of erosion in the basin for 2018, with recording the initial state of erosion for the studied region. This structured database can later be used to set up monitoring of these processes in a basin and as the starting point for further physical-geographical studies of the Komaraca river basin of the Upper Polimlje Region, taking into account the principles of environmental protection and sustainable development.

We quantify the intensity of erosion using computer-graphic methods and models. The research took previous experiences of the physical and geographical characteristics of the Polimlje Region (Spalevic et al, 2016, Spalevic et al, 2007). The intensity of soil erosion in the study area is quantitatively presented for the Komaraca River Basin, by studying the geological and pedological characteristics of the area, climate characteristics and analysis of state of vegetation.

The results of the study showed that the basin is with the very steep slopes. (A)symmetry of the basin, a , is calculated at 0.14, which indicates that there is a possibility of large flood waves appear in the basin. The density of the river basin network, G , is calculated at 0.41, which indicates that the density of the hydrographic network is low. The basin erosion coefficient, Z , is calculated at 0.454. This value is categorized by the studied basin in the 3rd destruction category by Gavrilovic (1972) classification. Surface erosion is dominant process. The actual land losses, G year, are calculated at 46231 m³ per year. The actual land losses per km², G year km⁻², were calculated at 521 m³ km⁻² year⁻¹. Using the

computer IntErO model (Spalevic, 2011), the quantification of the intensity of soil erosion and peak discharge in the Komaraca river basin was quick and easy. By establishing this new database with about 40 numerical parameters a simple and efficient warning system implementation of the ecosystem change will be provided.

Key words: Soil erosion, IntErO model, Polimlje, Montenegro

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Accuracy of reliability-resilience-vulnerability framework in watershed health assessment

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Abstract

Accuracy assessment of thematic maps of watershed health is critically important to an ongoing policies allocating in regards to natural resources protection strategies by governments, scientists and managers worldwide. Towards this, the present study assessed the accuracy of reliability-resilience-vulnerability ($RelResV_{ul}$) framework in health assessment of the Shazand Watershed (Iran). To this end, the watershed health was initially assessed according to standardized precipitation index (SPI), normalized difference vegetation index (NDVI), soil erosion, and low and high flow discharges criteria. The results of the $RelResV_{ul}$ framework based health assessment was then evaluated using field surveying and with the help of the Bureau of Land Management (BLM) and the Visual Soil Assessment (VSA) approaches. Accordingly, the data of more than 100 control points were used. The comparative results verified that the accuracy of $RelResV_{ul}$ was about 54 %. The results of the research could be a great of help to determine the effective factors of watershed health, detection of healthy watersheds, choosing homogenous regions, and sustainable and comprehensive watershed management.

Keywords: Anecdotal Observation; Ecosystem Health, Ground Check; Watershed Monitoring

Potential of Conservation Agriculture as carbon sequestration tool in Andalusia (Spain)

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Abstract

Agriculture is the main land use in the region of Andalusia (southern Spain), covering about 50% of the region. According to 'Surfaces and Yields National Survey' (MAPAMA, 2017), Agricultural area devoted to permanent crops was 1.94 Mha in Andalusia. While that cultivates with annual crops reached 1.22 Mha. The three principles of conservation agriculture (CA) are: minimum soil disturbance, soil cover with residues and living mulches, and crop rotation. The main techniques for these purposes are direct seeding (no-till) in annual crops and groundcover in the inter-rows of permanent crops. These practices leave plant residues covering the surface and keeping soil structure. The less tillage performed the less CO₂ is emitted from soil, thus, CA reduces the carbon loss through atmosphere. On the other hand, the decomposition of crop residues releases the carbon that the plants had sequestered through photosynthesis, into the soil improving the soil organic matter. Therefore, the potential of CA to decrease the atmospheric carbon must be highlighted. Some reviews estimate carbon sequestration rates between 0.85-1.54 MgC ha⁻¹ yr⁻¹ by use of CA. Direct seeding is especially implanted in Andalusia in winter cereals (wheat, barley), spring cereals (corn), legumes (pea, vetch) usually used in crop rotations, and oilseed crops (sunflower). Currently, 0.10 Mha are cultivated with this technique in Andalusia but it is only a 10% of the surface where it could potentially be used, so there is a considerable margin to be applied. Groundcovers are especially used in vineyards, olive, citrus and almond orchards. This management consists of keeping protected the inter-rows surface with seeded or spontaneous plants. In Andalusia, there are 0.75 Mha of permanent crops with groundcovers, that is, 39% of surface where they could be used. The promotion of CA would help to mitigate climate change while it protects soil from erosion.

Keywords: direct seeding; groundcovers; atmospheric carbon; annual crops, permanent crops

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Anaerobic co-digestion on agricultural wastes: studies of the effect of total solids on overall performance

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Abstract

Anaerobic digestion of agricultural wastes has been highly encouraged as a biological treatment approach in which the residue is stabilized and biogas, as a secondary product, is generated. The combination of various wastes, known as anaerobic co-digestion (AcoD), has shown to be an effective strategy in which nutritional synergies and diversity are enhanced, and lead to an improved performance of the process. The composition and concentration of the substrate are, nonetheless, key to the operation, as inhibition or low effectiveness can take place if the organic load within the reactor is not the appropriate. Additionally, it is also a crucial aspect at industrial scale because it conditions the speed of waste treatment.

This study covers the operation at mesophilic range (35 °C) of AcoD of six agricultural wastes (carrot, asparagus, artichoke, green bean, pea and bean) at four different configurations attending to the initial total solids (TS) concentration: 3 %, 6 %, 9 % and 12 % TS. Results indicated that for this organic substrate, a lower TS content can lead to a more efficient performance. Parameters such as organic matter removal were best for 6 % of TS, reaching 63.4 % of volatile solids (VS) elimination. The second best barely surpassed the half of this removal. Attending to cumulate productions of both biogas and CH₄, 6 % was once again the most successful, with 1.48 times more biogas than the two second best options (16.8 L-biogas for 6 %, 11.4 L-biogas for 3 %, and 11.2 L-biogas for 9 %) and 1.28 times more CH₄ (7.6 L-CH₄ for 6 %, 5.7 L-CH₄ for 3 %, and 6.2 L-CH₄ for 9 %). On the other hand, productivities were clearly better for 3 % of TS, reaching 332.7 mL-biogas/g-VS and 168.0 mL-CH₄/g-VS.

Keywords: Anaerobic co-digestion; agricultural waste; mesophilic; total solids; biogas.

Crop yield on hydromelioration soil in dry and humid years

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Abstract

Climate characteristics and soil water regime as well as their variable and complex interrelation define the efficiency of plant production, since a large part of our plant production is concentrated in regions with periodical occurrence of drought and surplus of precipitation. Therefore agricultural production is very risky on developed/undeveloped areas, especially when surplus and/or deficit of precipitation occurs before or during the growing season.

Investigations were conducted during years 2011 and 2015 at the experimental field in the central part of Croatia (45°34'46" N; 23°51'30" E), on soil type defined as hydroameliorated Gleyic Podzoluvisol. The trial involved four different drainpipe spacing variants (15 m, 20 m, 25 m and 30 m), set up in four replications, which are outflowed into the open channel (combined type of drainage). Variants covered areas from 1425 m², 1900 m², 2375 m² and 2850 m². As the trial crops were grown soybean and silage maize and the same agricultural practices were applied in all variants.

In the dry year 2011 there were small differences in the yield of soybean in the examined variants of drainpipe spacing, the yield ranged from 2.40 t ha⁻¹ achieved on the variant with a distance between the drainpipes from 20 m up to 2.29 t ha⁻¹, achieved on the variant with the largest distance between the drainage pipes. Determined yields were not statistically justified ($p = 0.05$). In wet year 2015, there were differences in the yield of silage maize on the investigated variants of drainpipe spacing. The highest yield was achieved on the parcel of distance between the pipes of 15 m (40.25 t ha⁻¹), then on the parcel of distance between drainpipes of 20 m (39.06 t ha⁻¹). There was no statistically justified difference between these variants, that is yields ($p=0.05$), but between these two variants and other variants there were justified statistical differences in yield.

On the hydroamelioration soil combined drainage with a distance between pipes from 15 m and 20 m should have a priority in central part of Croatia in humid year, but in dry year combined drainage, that is different drainpipe spacing have not influence on yield of crops.

Key words: hydroamelioration soil, drainpipes, dry and wet year, yield of crops

Characteristics of Rainfall of the Jablanica District for Irrigation and Drainage purposes

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Abstract

In designing systems for irrigation and drainage, precipitation is taken into consideration as one of the main elements of the water balance. The Jablanica District is located in the southeaster part of the Republic of Serbia. A weather station in Leskovac was selected as a representative for the analysis of precipitation.

The average annual rainfall is 645 mm. One-day, two-day, three-day and five-day precipitation levels in March-April and July-August for the period 1988-2017 are analysed for the purposes of setting irrigation and drainage systems. The empirical distribution was calculated using the Weibull method. Available recorded data are used to determine the parameters of Pearson III (Gama III) Log Pearson III, Log Normal, Weibull and Gumbel distributions.

The theoretical function that better fits the measured data is selected to determine characteristic precipitation levels of certain return periods. The empirical and theoretical distributions is checked by the chi-square and Kolmogorov-Smirnov tests. When it comes to monthly precipitation for July and August, the best matching with the measured values was shown by the troparametric Gama (Pearson III) and Weibull distribution.

When it comes to the maximum daily precipitation for March and April that are used for drainage, the results are as follows: The best matching of the empirical and theoretical distribution for March are Gamma (1 day), Log-normal (2 days) Weibull (3 days) and Log gamma (5 days). In monthly precipitation in April, the best matching is Gumbel (1 day) Gamma (2 days), Log-gamma (3 days) and Log-normal (5 days) distributions.

In practice, plots of empirical and theoretical distributions can be used for the identification of the precipitation level of a certain probability of occurrence (for the irrigation or drainage) depending on the requirements of a project's terms of reference.

Key words: precipitation, probability, irrigation, drainage

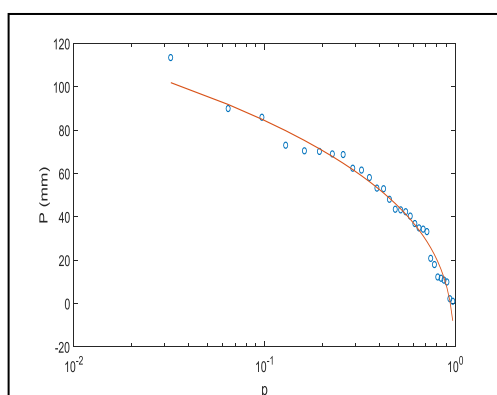


Fig.1. Empirical and theoretical Pearson III distributions, July, 1988-2017

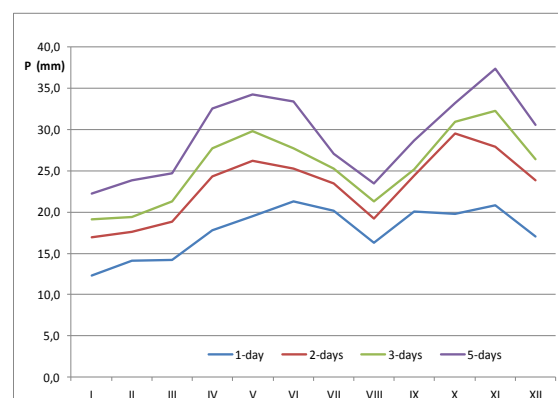


Fig.2. One-day, two-day, three-day and five-day precipitation levels

Spatial Data Infrastructure in Green Education

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Abstract

Functioning of modern society today is based on spatial data and their efficient use for decision making. With the progress of fourth industrial revolution, also named digital revolution, mentioned fact will become even more relevant. Efficient use of spatial data is based on standardized procedures of data collection, modelling, storage, use and dissemination. Spatial Data Infrastructure (SDI) is such standard focused on basic sets of spatial data. Implementation of SDI and geoinformatics technologies require in mentioned context new knowledges and skills. Knowledge and skills tied to use of spatial data incorporated in SDI concept represents new paradigm for all spatial data related professions. Towards modernization, standardization and level rising of SDI education on the universities in Western Balkans region, in the frame of Erasmus+ program, the BESTSDI has been launched. Recognizing global relevance of spatial data and SDI, project consortium gathered faculties providing study programs in geodesy, geoinformatics, geology, geography, mining, civil engineering, agriculture and forestry. Conducting detailed SDI education status and stakeholder's requirement analysis, project has developed SDI curricula which has been implemented at partner universities and is in test execution in academic year 2018/19. At the University of Montenegro Biotechnical Faculty in Podgorica and Faculty of Philosophy in Nikšić several courses have been modernized with SDI curricula content. Beside the new knowledges and skills introduction of SDI in study programs should improve understanding between professions and support interdisciplinarity. General information about BESTSDI project, its goals and expected results as well as information about implemented SDI courses are presented in this paper.

Keywords: Spatial Data Infrastructure, Education, BESTSDI, Erasmus

Alkali and alkaline earth metals in water - Case study of the Bojana River, Montenegro

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Abstract

Water is one of the most important natural resources. It is an essential substance for life and also is considered as a universal solvent capable of dissolving almost all solutes. Additionally, water is widely used in households, agriculture, and industry, and therefore water conservation should be a basic human need. The goal of this investigation was to determine the content of alkali (*Na*, *K*) and alkaline earth metals (*Mg*, *Ca*, *Ba*, *Sr*) in real water samples from the Bojana River, Montenegro, at two locations; **L1** - where Bojana River forms a small delta, and **L2** - where it flows into the Adriatic Sea. All samples were collected and tested in August 2017. The contents of metals in samples were determined by inductively coupled plasma with optical emission spectrometry (ICP-OES). Results have shown that the concentrations of alkali metals in sample **L1** were 793.40 mg/L (*Na*) and 39.32 mg/L (*K*), while in sample **L2** these values were significantly higher (1118.00 mg/L and 60.40 mg/L, respectively). As all alkali metal salts are well dissolved in water and due to the presence of a large amount of minerals in the sea, the obtained values in **L2** sample are expected. Nevertheless, the content of alkaline earth elements in **L1** were 81.59 (*Mg*), 59.54 (*Ca*), 0.01 (*Ba*), and 0.57 mg/L (*Sr*), while the concentration of these metals in **L2** were 106.90, 73.2, 0.01 and 0.84 mg/L, respectively. Further research will focus on assessing the impact of these elements on the living world in these waters, as well as their potential influence on human health, since these locations are very popular natural resources used for tourism.

Keywords: alkali metals; alkaline earth metals; ICP-OES analysis, Bojana River, Montenegro

Geographical potentials of the Nikšić Župa and the possibility of sustainable development

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Abstract

Nikšićka Župa, a space that is about 10km far from Nikšić, is often called "Geological mosaic", because in this area the powerful fluvial erosion of Gračanica and tributaries revealed the profile of sediments whose age ranges from Perm to the lower Kreda. Quaternary deposits are located at the bottom of the entire valley, especially in the central part. These deposits are also present in the higher part of the valley, especially in the area of the villages of Oblatno and Zagrad.

The relief is characterized by the dominant view of the valley and the surrounding mountains Maganik and Prekornic. These mountains are significantly karstic composition and landscape with characteristic and numerous scrapers, sinkholes, doline, scrubbers and caves. Dry and warm summers with relatively mild winters and high precipitation are characterized by the climate of Nikšićka Župa, with temperature amplitudes somewhat lower compared to Nikšić, resulting in frequent changes in direction of air currents. Villages from the Gračanica valley were the emigrating area, after the Second World War. Despite the relatively high natural growth, the number of inhabitants has stagnated, especially since the 1950s. The cause is reduced natural growth rate and increased emigration. All that was happening (the dissolution of the Socialist Federal Republic of Yugoslavia, economic sanctions, etc.) had a repetition of the rapid deterioration and deterioration of the economic conditions of life in the last decade of the 20th century. Nevertheless, mining and agriculture form the basis of further sustainable development and improvement of living conditions. Tourism is under development and no significant improvements have been made in relation to earlier periods. The vicinity of Nikšić, favorable geographical position, great natural potential (especially in mining) are favorable and Zupa Region is, according to our analysis, a Region with potential for further development.

Key words: Landscape, relief, development, tourism, geography

Floods on the River Beljanica in May 2014

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Abstract

Catastrophic flooding caused by a prolonged cyclonic activity in May, 2014, affected a wide area of Serbia, Bosnia and Herzegovina and Croatia. A cyclone activity supported by stormy winds, created the conditions in this area for a vast amount of precipitation, on average of 150 - 250 mm and more. The period preceding the catastrophic floods was characterized by prolonged low rainfall intensity, so that the soil was completely saturated with water. On such a saturated soil subsequent enormous rainfalls caused a sudden swelling and concentration of water in the small and large watercourses. The coincidence of high waters in all basins in the wider area was very pronounced. In this paper has been presented the flood wave on the river Beljanica, the right-side tributary of the Kolubara River, central Serbia. The aim of this study was to analyse the flows of high water in the riverbeds of the medium-sized watercourses, of the catchment area up to 1000 km². Based on the registered markings of large waters during the floods and after the cessation of the flood wave, the reconstruction of high waters was done in order to review the scope and size of the floods.

Keywords: flash floods, small river basins, water flow, sediment transport, flood wave.

Evaluation of Synthetic-Color-Contrast Aggregates: Soil Splash Measurement

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Abstract

Soil erosion causes permanent soil and nutrient loss and environmental problems. In general, the first stage in erosion is the splash erosion caused by the impact of the rain drops with soil surface. In this step, the soil aggregates are broken down and crushed and the finer separated particles are prepared for transfer easier by runoff and for this reason, understanding the influencing factors on splash erosion is very important in soil erosion studies. The detachment rate is related to rainfall and aggregates characteristics especially the diameter of the aggregates, which has been less considered in soil erosion studies. The present study was aimed to evaluate the efficiency of Synthetic Color-Contrast Aggregates (SCCA) in soil splash measurement. The synthetic aggregates were made using pumice as a base material, aggregated with white cement and colored with yellow pigment powder. Both natural and synthetic aggregates were then separated in three classes of 1.18-2.36, 2.36-3.35 and 3.35-4.75 mm in diameter with the average diameters of 1.77, 2.89 and 4.05 mm. A splash cup was used to measure soil splash under simulated rainfall with the intensity of 60 mm h⁻¹ and the duration of 15 minutes. The results showed that the average amount of total and net splash decreased significantly with increasing in the diameter of both soil natural aggregates and SCCAs. With increasing the diameter from 1.77 to 4.5 mm (about 2 times), the amount of total and net splash decreased about 6.1 and 5.4 times for natural and synthetic aggregates, respectively. Despite the same behavior of both natural and synthetic aggregates, the SCCAs overestimate soil splash (averaging 5 to 6 times) and these findings should be considered in soil erosion studies using this type of synthetic aggregates.

Keywords: Net splash, Rainfall simulation, Soil aggregates, Splash cup, Total splash

Biomass as a renewable energy source

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Abstract

Field crops are in the usage for the biofuels production. Biomass is the largest renewable energy source. Serbia belongs to the top of european countries in quantity available and unused biomass. degraded soil can be a significant factor to contribute to the orientation of the growing of agro-energy crops. although accelerated development and the spread of these crops under sharp criticism and doubts about their validity and economic justification, the last two decades have been recorded by establishing a large number of plantations miscanthus in the countries of western Europe, and the last eight years and Eastern Europe and the Balkans.

As pointed out by Christian et al. (2008) regarding the ability of nutrients and minerals translocation from the aerial parts to the rhizomes from September to March, *Miscanthus × giganteus* is characterized by high efficiency of nutrient usage and can produce large amount of biomass over 15 years without adding nutrients, thus significantly reducing the financial inputs, compared with the cultivation of annual energy crops such as maize.

Analysts assert the inevitable increase in food prices and social problems in developing countries. these problems could be resolved by further improvement of ethanol producing technology from cellulose. High-quality energy crop should have adequate adapting capacity and affordable conversion of accessible solar energy into biomass with maximum efficiency, minimal inputs and favorable impact on the ecosystem (Heaton, 2004; Živanović et al., 2014). Participation share of biomass use as renewable resources in the energy sector, from the aspect of environmental protection, in conditions of adequate use, contributes to a significant reduction in net CO₂ emissions in comparison with the use of fossil fuels for energy purposes.

In the paper processed development opportunities and the expansion of bioenergy crops which one will with the life cycle contribute to environmental protection.

Keywords: agro-energy crops, biomass, degraded land, energy sector, environment

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Response of soil quality index to land degradation in a dust storm affected region

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Abstract

Dust storm is one of the environmental issues that has been increased significantly in recent years exclusively in arid and semi-arid regions. Southeast of Ahvaz, Khuzestan is known as the momentous source of dust in recent years in Iran. Due to both adverse effects of dust storm and the sensitive conditions of the arid and semi-arid regions, the huge amount of the soil as an important part of the sustainability of ecosystems are degraded. Thence, extensive studies on the soil characteristics of affected regions by dust storms are imperative to draw a road map to achieve sustainable development and optimize use of natural resources. Towards this, the present research was formulated to characterize the soil quality state of southeast region of Ahvaz as an elementary and pioneer research in the region to develop a basis to develop an integrated plan for land degradation assessment. The used criteria to meet the objective of this research were percent of clay, silt and sand, overall aggregate mean weight diameter (MDW), organic matter (OM), wind erosion threshold (WET), electrical conductivity (EC), power of hydrogen (pH), total neutralizing value (TNV) and sodium adsorption ratio (SAR). Hence, the Nemer Quality Index (NQI) as a simple way to evaluate soil quality was computed for 26 land units of the study region. The NQI is based on the average and the minimum criteria score, only. The results approved the poor quality condition of the study soil with value of NQI of 0.50 ± 0.08 . The NQI was ranged from 0.35 and 0.66 through all 26 study land units. The NQI less than 0.35 indicated that the soil has the most severe limitations for plant growth. As a result, sound best management activities are required, in dust storm affected regions of Ahvaz. This study suggests that using soil quality indices could provide valuable results for decision makers and land managers.

Keywords: Edaphic characteristics, Soil indicators; Southwestern Iran, Desert region

Scope of factors influencing the assessment of risk degree of the Seveso plants

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Abstract

The amount of hazardous substance is one of the criteria for determining the risk degree of Seveso plant and usually defined by the legislation with the list of dangerous substances. Although it is an important criterion, it is not sufficient for expedient consideration of the accident hazards. This research presents the influence of the amount of hazard substance on the shape and extent of the accidental hazards and underlines necessity of recognizing important factors that also affects the security of chemical plants. As subject of the investigation were selected two LPG storages in Montenegro with different spatial positions, environmental surroundings, structures, various types of tanks e.g. pressure vessels, as well the different stored quantities of LPG. The applied methodology for determining the risk degree of chemical hazards included three phases: hazard identification, analysis of the consequences and risk assessment. Based on the obtained results presented that the quantity of dangerous chemical is not the only factor nor basic measure of the potential scope and consequence of hazard. The chemical risk management methodology must cover more criteria in order to be expedient and useful. For the purpose of real risk assessment and chemical protection planning, the main legislative instruments that regulate this issue apart from laws and strategies for emergencies must include a rulebook on the methodology for assessment of the chemical and environmental hazard, the measures of preparation and the measures to remove the consequences.

Keywords: legislation; accident; LPG; risk, Seveso

Testing the possibility of improving the low-temperature characteristics of biodiesel by additivation

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Abstract

Biodiesel, an alternative-diesel fuel derived from vegetable oils, or animal fats, and consists of mono-alkyl fatty acid esters of a long chain. In its production, the raw material has the highest share in price, which favors the use of cheap raw materials, most commonly different heat-treated waste vegetable oils (restaurant oils).

When manipulating and using biodiesel and its mixtures, one of the most serious problems is its low temperature properties. The problem with low temperature characteristics is intensified by its use in the winter period. Due to its nature, conventional transesterification methods can not affect the improvement of low temperature properties, and its quality must be improved by cold flow improvers.

This paper examines the performance of commercial additives to improve low temperature characteristics. The low-temperature properties were tested: filtration, CFPP (Cold filter plugging point) and flow point, PP (Pour point), standard methods according to EN 116 and ISO 3015. Samples were selected as sample samples, accepted for border cases : difficult to add, "old" biodiesel (stored for more than 6 months), which is a mixture of palm oil and rapeseed biodiesel, and an additive additive, "fresh" biodiesel with a pre-added additive for oxidative stability. The effect of the same additives has been tested and for 5% biodiesel + ULSD mixture to examine how they act on this mixture (the dominant effect on ULSD, low sulfur diesel fossil origin).

Key words: Biodiesel, low temperature properties, additives

Design of large scale on-demand irrigation system in the agricultural area of Corato, Apulia, Italy

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Abstract

The objective of this project was to design a collective, on-demand irrigation network for an agricultural area near Corato, province of Bari, Apulia region, southern Italy. For this purpose, a study integrating agronomic, engineering, economic and environmental aspects has been conducted. The goal was to evaluate the ability to supply agricultural lands with irrigation water in order to cover the cropping pattern requirements in this district during the peak period of a dry year. After collecting and processing the climatic data for 30 years period, as well soil characteristics, crop water requirements have been determined. Besides that, modelling tool CROPWAT generated curves of yield response to different amounts of irrigation applied. The most optimal cropping pattern is chosen in socio-economic part through a predictive model, consisting of 3 annual (watermelon, tomato, lettuce) and 3 permanent crops (peach, grapevine, olive). Furthermore, sensitivity analysis have been done in order to avoid future risk and to predict farmers' behaviour. The irrigation network was designed based on the specific continuous discharge (0.422 ls-1ha-1) which was computed based on GIR values for the peak month of the dry year. A layout of the distribution network is computed by Geographical Information System (GIS) including reservoir, main pipelines, secondary pipelines, nodes, 38 hydrants with a module of 5 ls-1 and 23 hydrants with a module of 10 ls-1. Several tools (air and relief valves, control gates) are included in the network as well. Optimization model was used in order to calculate pipe diameter and their length (13271.7 m). In addition, storage reservoir was designed, as well as pumping station with 4 horizontal and 2 submerged pumps and pressurized regulating tank that controls opening and closure of the pumps. Cost and benefit analysis showed that the project is cost-effective on social basis and will fully recover its investment in two years, with an economic rate of return of 129%. An environmental impact assessment was conducted for the project and neighbouring area and it showed that they are not affected negatively. In addition, good management and monitoring practices to minimize the potential negative environmental impact are required and proposed for long-term sustainability of the irrigation project.

Keywords: irrigation, hydrant, discharge, crop water requirements, precipitation, yield, groundwater.

Soils of North Montenegro and their production potential for organic agriculture

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Abstract

Sustainable agriculture is a production system that, over a period of time, is improving the quality of the environment and the resources on which production is based, satisfying needs in food, economic cost-effectiveness and improving the quality of life of farmers and the whole society. The technology of plant cultivation in such a system relies on the application of organic fertilizers, as the most important source of plant nutrients. The area of Montenegro is 13812 km², of which the agricultural land area participates with 5166 km² (37.4%), which is about 0.80 ha per capita, whereby Montenegro is at the top of the countries in Europe. However, the total agricultural area of Montenegro cannot be completely valorized. Predominate are mostly shallow lands with low production capacity. According to the data of the Ministry of Agriculture, Forestry and Water Management, the agricultural production participates with around 15% of GDP, and about 20% in employment. Production harmonized with the principles of sustainable development and environmental protection is a priority in the development of Montenegrin agrarian sector. Montenegro is characterized by favorable natural and agro ecological conditions for the development and improvement of organic agriculture. The aim of this research was to review the production potential of the Soils of the North Montenegro, their fertility and the opportunity for organic agricultural production, while looking at the aspects of sustainability. Based on the results of the research and reviewed literature, the analysis of soil samples did not determine the presence of heavy metals. The production potential of the examined soil types depends on their physicochemical properties, depth of the horizon, relief and climate. The formation of studied soil types was significantly influenced by relief and climatic factors. Organic production can be organized in this region. The relief, the climate and soils of the North of Montenegro, their existing condition and land use would correspond to the more natural way of food production according to the principles of organic agriculture, so that this area can be used for the production of crops, fruits: raspberries, blackberries, blueberries, apples, pears and plums, and the production of certain types of bulky food (hay, sage, silage) for domestic animals grown in the organic farming system. Land, climate and relief with their current state and existing basic characteristics favour further development of organic agricultural production, especially in the studied area and the region of Northern Montenegro. Based on the results of these surveys recommendations are made for the implementation of appropriate agronomic procedures, in order to prevent or stop erosion, increase the biological productivity of the land and assimilate the same purpose - for agriculture, plant production and cattle breeding, and especially organic agricultural production.

Keywords: Soils, North Montenegro, Organic production

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Assessment of phytoremediation potential of cereals in petroleum hydrocarbons mixed soil

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Abstract: Plants especially legumes and grasses have been identified to play important role in remediating oil polluted soil in both laboratory and field trials. The initial physiological response of plants to PHCs in soil includes PHC uptake, translocation, and accumulation in organs such as roots and shoots and the rates of these processes are generally related to PHC concentration. This study was conducted to evaluate the growth and phytoremediation potential of cereals in soil mixed with petroleum hydrocarbons. Rye (*Secale cereale* L.) was selected, as crop with high potential to phytoremediate soil mixed with petroleum hydrocarbons, barley (*Hordeum vulgare* L.) and wheat (*Triticum aestivum* L.) were selected with demonstrated potential to tolerate soil mixed with petroleum hydrocarbons. The study involved a laboratory experiment conducted on (0.0, 3.0 and 5.0) % (v/v) soil mixed with petroleum hydrocarbons, in three variants with two replications. After 30 days, percentage of emergence in wheat was between (52.80 and 76.17) %, in barley was between (71.62 and 85.14) %, while in rye was between (62.90 and 79.84). The plants were able to grow on all contaminated soil. The results of the biodegradation of petroleum hydrocarbons showed that great reduction (23.43 %) of total petroleum hydrocarbons (TPHs) was observed in the 3.0 % soil mixed with petroleum hydrocarbons planted with rye, as compared to 14.28 % and 14.70 % reduction of wheat and barley respectively. The present results evidently demonstrated that rye provided effective phytoremediation process of a soil mixed with petroleum hydrocarbons, as compared to the other two cereals.

Keywords: phytoremediation, petroleum hydrocarbons, soil, cereals

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Content of the trace elements in corn grown on the territory of the municipality of Mali Zvornik in the Republic of Serbia

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Abstract

In the area of Mali Zvornik municipality, during 2017 on plots of agricultural land 12 soil samples to the depth of 30 cm depth and plant material was collected. The survey included observations was carried out on six types of soil and one plant species (the analysis was carried out on corn grains). The content of Pb, Ni, Cr and Cd was determined in the soil and plant material. At five sites, the trace element content in the soil was above the maximum permissible levels (MPL). At two sites, the content of lead (Pb) was above of MPL, on one site nickel (Ni) content was above of MPL, on one content of nickel (Ni) and lead (Pb), and on one site content of chromium (Cr), nickel (Ni) and lead (Pb) was above the MPL.

The content of the examined elements in the samples of plant material (corn grain) at sites with the content of trace elements above the MPL was either below the detection limit or within the limits of the normal values for this plant species, except in one sample where the lead content was above the allowed values for human consumption. Despite the value of the trace elements above the MPL for soil, the value of the examined elements in the analysed plant samples was not above the toxic values (TV), which indicates that the translocation is affected by the set of physical-chemical properties of the soil, the place of accumulation and the physiology of the plant species. The assumption is that the increased lead content in one corn grain sample is due to air pollution.

Keywords: trace elements, translocation, corn grain.

Water quality assessment for irrigation from the South Morava River

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Abstract

During 2013, in July, August and September, samples were collected from 37 locations from the South Morava River, used for irrigation of agricultural soil directly along the river. The suitability of water for irrigation is assessed by the Stebler, Nejgebauer, US Salinity Laboratory, FAO and RSC classifications. The obtained results indicated certain limitations in the quality of the samples of water samples from South Morava at certain locations during August (area Pavlovac and Zlatokop) and in September (area: Bujanovac, Srpska kuća, Pavlovac, Donji Neredovac, Zlatokop and Suvi Dol). The content of microelements and heavy metals in all tested water samples was below the maximum permissible levels in relation to the legal regulations of the Republic of Serbia. Based on the obtained results, it is estimated that South Morava river water can be used for irrigation with restrictions at places where limitations were recorded during the summer months, in order to protect agricultural soil from further degradation.

Keywords: Classifications, irrigation, water

Effects of tomato processing on carotenoids and antioxidant activity and their stability during one-year storage

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Abstract

Certain nutrients of pasteurized tomato juice degrade during storage. This degradation may lead to loss of the typical compounds, which doesn't result in spoilage, but lead to less advantageous food contents. Therefore the degradation of carotenoids (lycopene and β -carotene) and total antioxidant activity was investigated after one year storage. Tomato juice, thermally treated for 7 minutes at 100°C, was subjected to one-year storage in the a) light at 20°C; b) in the dark at 20°C and c) in the dark at 4°C. Every two months, the degradation of carotenoids (lycopene and β -carotene) and total antioxidant activity was investigated. The β -carotene had the fastest dynamics of the degradation and was dissolved in the largest quantities, regardless to the storage conditions. For all investigated components decomposition was fastest in the first two months, when the sample was stored in the light and at 20°C. Lycopene was the most stable in the sample stored in a dark place at 40°C. Partial regression coefficients for all researched traits proved the significant difference of ratio for storing in light (20°C) comparing to variants stored in the dark at 20°C and 4°C, lycopene $p=0.0041^{**}$, $p=0.0304^{**}$; β -carotene, $p=0.0009^{**}$ and $p=0.0183^{**}$; antioxidative activity $p<0.0001^{**}$ and $p=0.009^{**}$.

Keywords: tomato juice, one-year storage, lycopene, β -carotene, antioxidative activity

Formation of fertility and productivity indices of reclaimed soils under conditions of regional climate change of the South of Ukraine

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Abstract

The paper summarizes the results of research on the dynamics of changes in climatic parameters (air temperature and rainfall) over the 70-year period (the end of the XX and the XXI centuries) in the agro-soil zones of south of Ukraine; the main factors of the negative influence of elevated temperatures on properties of soils are revealed; the optimal parameters of agrotechnical measures for the reduction of the risk of insufficient soil moisture and increase of agricultural stability are substantiated.

The represents the methodological approaches and the results of the evaluation of integrated space-time modelling of the heterogeneity of changes in agrochemical properties of soils in the steppe zone (on the example of Kherson region of Ukraine) under conditions of regional climate change. The paper evaluates the changes of soil-climatic potential of agricultural lands depending on climatic conditions and suggests their comparative estimation by fertility; it determines the total agrochemical potential of dry-steppe soils and develops the gradation according to their ability to maintain steady yields of grain crops.

The paper simulates the changes in energy expenditure on soil formation during the development of irrigated agriculture.

The study develops the models and the maps of productive moisture content in soils for demanding and less demanding crops for the development and implementation of reclamation measures aimed to increase soil fertility of the dry-steppe zone.

The paper suggests the system of nature protection measures for management of agricultural lands considering the qualitative estimation of soils (including irrigated lands) to determine the changes in the potential of reclaimed soils, increase informational content and objectivity of management decisions concerning the development of land reclamation measures and optimization of agricultural land use under conditions of regional climate change.

Key words: climate, soils, fertility, productivity, irrigation, yield.

Assessment of suitability of agricultural use for organic farming on the South Ukraine

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Abstract

Organic farming in Ukraine is dynamically developing. Over the past ten years, the area under the production of organic products has increased almost threefold. The subjects of the market of organic products in the Kherson region are 20 agricultural enterprises that process more than 11,3 thousand hectares of land.

In the structure of exports of organic products, 68% are grains, 18% technical, 9% fruit and vegetable and 5% others. The main countries of consumers of organic products are Germany, Austria, Poland, Italy, France, Holland, Denmark, Switzerland, Canada, and USA. Despite the rather high agro-resource potential of the Kherson region, areas under organic farming occupy only 0.64% of the total area of arable land.

Most of the agricultural lands of the Kherson region are southern chernozems (41,8%) and dark chestnut soils (21,0%) with heavy texture, 70,8% of the soils have medium and high humus content, an average content of mobile phosphorus and a high content of exchangeable potassium. Less e are provided with easily hydrolyzable nitrogen.

The content of heavy metals in the soils of the Kherson region does not exceed the maximum permissible concentrations. Residual amounts of organochlorine compounds, 2,4-D and other pesticides have not been identified. The content of radionuclide's (cesium and strontium) in the soils of the region is stably low and does not exceed the maximum permissible concentration.

Taking into account that the Kherson region has the status of an ecologically clean zone, in conditions of increasing demand for organic products - it has prospects for developing export potential while simultaneously addressing economic and social problems. To do this, it is necessary: to formulate the appropriate regulatory and legal framework, to introduce certification and labelling of organic products, to provide state support to farms during the transition period, to develop innovative technologies for growing organic crop production, to intensify information and advisory work.

Key words: Organic farming, Kherson region, South Ukraine

The importance of amelioration on soil and water resources in the rural areas of Turkey

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Abstract

The main problems on soil and water sources in Turkey are over irrigation, over grazing, erosion in the inclined terrains and irrigated areas, run off and soil losses. The reasons of all these are climate, topography and mismanagement of natural resources. Erosion frequently occurs because of topography, geological structure, geographical location, land and climatic conditions and mismanagement of natural resources. Considering all these, the purposes of small scaled investments on soil and water resources in rural areas are (i) to provide sustainable economic development, (ii) to increase in overall welfare level, (iii) to decrease in unemployment, (iv) to protect and improve the environment. Some regional and local small projects on development and improvement on soil and water resources in Turkey have been implemented. A wind erosion control project in Karapınar is one of good examples in the world. A catchment improvement project resulted in increasing household incomes in the target micro-catchments on average 53 % between 2005 and 2012, soil fertility on sloping lands increased by more than 20 %, vegetative cover increased in the project area by 77 % above baseline over the seven years of the project, over 30 % of farmers adopted environmentally friendly agricultural practices and 60 % of farmers adopted improved manure management. On the other hand, with the control of erosion, reforestation, the rehabilitation of degraded forest lands, pasture rehabilitation, improvements in irrigation systems technologies in agricultural lands and the ongoing rehabilitations, the transported soil has been decreased from about 500 to about 178 million tonnes/year.

Keywords: amelioration, land management, natural resources, rural area, soil erosion, Turkey

Interaction of compaction and texture on aggregate size distribution in vineyards in a cultivation period

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Abstract

Aggregates are considered to be soil's construction units and can be found in different sizes and shapes. They may be formed or destroyed during the swelling-shrinking process or from external forces, like mechanical compaction. Soil texture can determine the effect of compaction on the physical and mechanical properties of the soil. A reliable indicator to estimate compaction effects on the physical and mechanical properties of the soil are aggregate size distribution changes. Bigger agglomerate sizes prevail when the compression increases. The aim of this work was to study the effect of compaction on the aggregate size distribution (ASD) and mean weight diameter (MWD), on the surface (0-15 cm) soil of three vineyards with different texture, at two time intervals during a cultivation period. Three conventionally cultivated vineyards were selected to be studied. The vines were planted in rows and the tractor circulation took place in the corridors within the rows. The sampling was carried out in May when agricultural vehicles had accomplished 6-8 passes/ corridor, and in October 2016, after ca. 20 passes/ corridor. From each vineyard were collected soil samples: uncompressed (U), on the planting line between the stumps and compressed (C), in the runway between the rows. The soil samples were air-dried and crumbled to aggregates by hand, along the planes of weakness. The ASD was determined by dry sieving the <8 mm material in a series of sieves with openings of 4, 2, 1, 0.5 and 0.25 mm diameter. The MWD was also calculated. Statistical differences of MWD were estimated by ANOVA with a single factor at a significance level of 0.05. In the beginning of the cultivation period (May) and after a few passes per corridor, in the two fine textured vineyards (CI and CIL), compaction favored the formation of large aggregates in comparison to the uncompacted samples. In the end of the cultivation period (October) the ASD in the vineyards was not further affected by machinery traffic. On the contrary, in the SiL vineyard a larger number of tractor passes was needed to affect soil aggregate size distribution, as more aggregates of big size were formed in October. In the uncompressed samples no differences were found between the two time periods, with the exception of the CI soil. In general, the effect of soil compaction caused by vehicle circulation in vineyards on ASD, was pronounced in spring. Soil texture determined the extent of soil compaction on aggregate size distribution. Fine textured soils were vulnerable to vehicle circulation from the beginning of the cultivation period, while more passages were demanded to shift the ASD towards the predomination of bigger aggregate sizes in the presence of increased sand percentage.

Keywords: soil texture, compaction, aggregates, vineyards

Agricultural waste to wealth: enhance food security and conserve environment

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Abstract

Agriculture is the basic source of food supply of all the countries of the world, whether underdeveloped, developing or even developed. Due to increasing population in underdeveloped and developing countries leads to increasing demand for food production at a faster rate, which has in turn led to the production of large amounts of agricultural waste both at the farmer, municipality and city levels. Agricultural development is usually accompanied by wastes from the irrational application of intensive farming methods and the abuse of chemicals used in cultivation, remarkably affecting rural environments in particular and the global environment in general. The impact of agricultural waste on the environment depends not only on the amounts generated but also on the disposal methods used. For example, agricultural waste burning is a common practice in the undeveloped countries, but it is a source of atmospheric pollution. Environmental pollution from animal waste (faeces, urine and respiration and fermentation gases) is a global concern. Agricultural wastes can be used to enhance food security mainly through their use as bio-fertilizer and soil amendment, use as animal feed, and energy production. Turning these agricultural wastes (crop residues and animal manures) into organic fertilizers (through composting) is one of the waste management technologies that make it possible to use organic waste as a fertilizer even in populated areas. Technology plays a key role in soil fertility improvement and hence crop productivity. Agricultural wastes can be a valuable resource for improving food security, however, if not disposed properly, agricultural wastes are likely to cause pollution to the environment and harms to human health. This calls for increased public awareness especially in developing countries on the benefits and potential hazards of agricultural wastes.

Key words: agricultural waste, food security, conservation, environment

Morphological and Micropedological Properties of Paddy Soils in Doroud Area, Lorestan Province, Iran

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Abstract

Rice is an important agricultural commodity which is produced under flooding conditions and long term reduction. This soil quality affects plants and organisms growth, and also causes a special situation for creating different chemical and morphological states. The study area was Silakhor plain located in the northwest part of Dorood in Iran. In this study, morphological, physical-chemical, and micromorphological characteristics of seven profiles were evaluated. Results indicated that rice cultivation in the long term induced clay accumulation in low depth of all profiles and decreasing soil cation exchange capacity. Flooding conditions influenced the amount of soil organic matter only in the surface horizon. Micropedology results confirmed the observed pedofeatures under the condition of the continuous flooding condition of the paddy rice. In most cases, Fe, Mn pedofeatures increased with depth and encompassed a high percentage of S-matrix. Other micromorphological processes includes: loose discontinuous, dense complete and dense incomplete infilling of Fe-Mn sesquioxides in voids and channels walls. Our results showed that the most void percentage is the planar, channels and chamber voids. These percentages were reducing with increasing of depth. The pedality degree reduced with increasing of depth. The common b-Fabric in all thin sections was observed from crystallitic b-Fabric form.

Keywords: Paddy rice; Fe-Mn sesquioxides; voids

Anaerobic digestion of lignocellulosic substrates and the impact of thermal pretreatment: asparagus

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Abstract

Anaerobic digestion (AD) of agricultural wastes has been promoted as an efficacious way of treating organic residues through biological pathways. However, the composition of the substrate has a key effect on the overall performance of the process. For instance, highly lignocellulosic wastes, such as asparagus, are recalcitrant to anaerobic degradation due to retarded mass transfer, low access of the microbial population to the substrate, etc. The literature has widely discussed the effectiveness of pretreatments on substrates to be further degraded through AD. Among them, thermal pretreatments have shown to improve the operation mainly due to the solubilization of organic matter and the loss of its semi-crystalline structure that hinders the degradation. This study covers the impact on thermophilic (55 °C) AD of a mild thermal pretreatment (80 °C for 1.5 h) applied on asparagus waste, as a representative of lignocellulosic waste, comparing the performance of the process without pretreatment. The results indicated that this thermal pretreatment did not show significant differences on the removal of organic matter in both processes. However, the efficiency was highly boosted, reaching productivities of 387.3 mL-biogas/g-VS and 292.9 mL-CH₄/g-VS, values 1.20 and 1.47 times higher than for asparagus AD without pretreatment, respectively. Moreover, the quality of the biogas was improved, with a 75.6 % of CH₄ within the biogas produced, as opposed to 62.1 % when the waste was not pretreated. Additionally, the study of microbiological populations has allowed the monitoring of each stage, showing an appropriate performance of the process. Based on the results, the thermal pretreatment can be an interesting option to improve the AD of lignocellulosic wastes.

Key words: Anaerobic digestion; lignocellulosic agricultural waste; asparagus; thermophilic; thermal pretreatment

Mapping salinity and pH of surface and depth soil by using geostatistical techniques and GIS in Qazvin plain (in Iran)

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Abstract

Understanding the spatial variability of soil surface and depth features and capabilities in order to obtain detailed information about land and using them to the best and the most profitable type of productivity is essential in sustainable management of soil resources. This study aimed on geostatistical mapping of soil surface and subsurface salinity and pH in 17,000 hectares of the Qazvin. For this purpose, after drilling 61 profiles, soil samples were taken from soil horizons of the profiles. EC and pH of the samples were measured and their weighted averages for 0-30 and 0-100 cm depths were calculated. Spatial variability of the above mentioned characteristics was studied, using variogram and the ratio of nugget effect and sill variances. For mapping of the characteristics, Kriging, present in the ArcGIS 10 software was used. The results showed that in the both depths, exponential and gaussian models were the best for pH and EC, respectively. Maps of kriging demonstrated that the spatial variability of the soil salinity is high in the studied area. The reasons for this high variability are high surface area of the region, presence of different physiographic units and management level.

Keywords: Spatial variability, Variogram, Nugget effect, Kriging estimator

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Environmental trends in Montenegro: Land degradation neutrality

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Abstract

Land degradation neutrality (LDN) is an integral part of the 2030 UN Agenda for Sustainable Development. Montenegro actively works on LDN target setting process. This paper aims to present: (a) the basic principles of LDN concept, (b) global datasets provided by UNCCD, (c) SWOT analysis for the country, and (d) to discuss possible national datasets and further activities related to LDN.

LDN Target indicator is measured by means of three sub-indicators: land cover, land productivity and soil organic carbon (SOC), and it could be broaden with national indicators. Country has been provided by UNCCCD with global dataset on three sub-indicators, as well as with watershed boundaries, but is encouraged to utilize their own datasets.

ESA land cover data indicate the conversion of 2460 ha of forests into to croplands or shrubs. Land productivity dynamics data indicated that 74300 ha of territory have sort of negative trends in land productivity. SOC at the country level indicates average content of 125.1 t/ha. Ten potential hotspots in the country had reduction of land productivity dynamics caused by wildfires, whereas five hotspots had multiple drivers of land degradation among which fires, agricultural abandonment and urbanization are the most important. Although there is a certain inaccuracy in global datasets, the country decision is to utilize them in defining LDN baseline. The national working group defined four specific voluntary targets: (1) Avoiding, minimizing land degradation, and redirecting land use changes, (2) Increase of land productivity - reduction of soil degradation, (3), Protection of natural ecosystems from wildfires, and (4) Improvement of soil monitoring system. Accordingly, 25 associated measures are defined to achieve LDN up to 2030. They are related to enhancement of LDN baseline in Montenegro, environmental legislations, direct measures to prevent, minimize land degradation and restore degraded land, sustainable agriculture and forestry, land use changes and social awareness.

Keywords: LDN TSP; indicators; land degradation; Montenegro

Land quality improving

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Abstract

In the past decade, management of historically contaminated land has largely been based on prevention of unacceptable risks to human health and the environment, to ensure a site is “fit for use.” More recently, interest has been shown in including sustainability as a decision-making criterion. Sustainability concerns include the environmental, social, and economic consequences of risk management activities themselves, and also the opportunities for wider benefit beyond achievement of risk-reduction goals alone. This article presents a framework for assessing “sustainable remediation”; describes how it links with the relevant regulatory guidance; reviews the factors considered in sustainability; and looks at the appraisal tools that have been applied to evaluate the wider benefits and impacts of land remediation. At The main activity of Greenroom is treatment of mud from waste water treatment plants in Montenegro. The problem with the plant of waste water treatment in Montenegro is similar or almost the same as in all plants of Europe. The drive itself efficiently purifies wastewater but there is a build-up of waste sludge. The problem of waste sludge is solved in two ways. At the end pilot project made in Montenegro by Greenroom Company is briefly described. It is proposed that a practical approach to integrating sustainability within risk-based contaminated land management and offers the possibility of a substantial step forward for the remediation industry

Key words: Land quality, sustainable remediation

Structural design of the agricultural territory accounting for erosion control

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Abstract

Soil quality depends on the topography and type of land use. Significant disadvantage of the flat areas is their vulnerability to wind erosion, while >3% slopes make the areas vulnerable to sheet water erosion. Considering only the out-of-eligible-losses, 51% of the total soil losses in Bulgaria are from the cropped fields. These negative processes currently deepen due to chaotic land use that is not based on scientific grounds for erosion control and for efficient use of the agricultural machinery. The last agrarian reform, which enabled the process of restoration of land ownership rights created good preconditions for erosionally hazardous land use and the state doesn't take serious practical measures to avoid or control its performance. The paper presents update of rules and standards for territory planning of the crop rotation area and its field road network in different topography conditions. In support of that, firstly, the legal gaps on land use and design were detected and analyzed. Some possibilities for completing the legal framework were justified. Secondly, theoretical research, using terrain measurements of the performance of the agricultural machinery and their impact on soil quality in the arable land of farms was conducted. Spatial dimensions of the cropped fields and allowable working directions relative to the horizontals in different soil-topographic conditions, as well as standards for the field road network design are recommended

Keywords: agricultural territory, land use, erosion control, spatial planning, legislation

Optimization of indicators for assessment of agroecosystems condition under the DPSIR approach

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Abstract

In April 2013, the European Commission issued the "Mapping and Assessment of Ecosystems and their Services" report related to the European Union Biodiversity Strategy by 2020, according to which every Member State, including Bulgaria needs to assess and map the state of the ecosystems condition on its territory as well as the ecosystem services (the benefits and goods derived from ecosystems) they provide. One of the world-wide approved approaches for selection of ecological indicators that can be used for assessment of the ecosystems condition and ecosystem services is the DPSIR approach (driving forces - pressure - state - impact - responses). During the implementation of this method, networks made up of causal links are created, analysis of which leads to selection of the relevant indicators. These networks also provide an opportunity to define the significance of each indicator. On the basis of a detailed analysis of the indicators selection, a method for establishment of reduction coefficient is proposed. It is aimed at indicators optimizing and increasing the accuracy in the final assessment of the biophysical condition of the agroecosystems.

Keywords: agroecosystems; ecosystem services; DPSIR; ecological indicators; ecosystems biophysical condition assessment; ecosystem services assessment

Acid track in different types of soils in the Middle Urals

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Abstract

Soil acidity is one of the most important properties that determines the emergence of a specific organization of the soil profile. Introduced the concept of "acid trail soil-forming process" in the field of acidity. This is a trace, reflecting the distribution of acidity over the soil profile. The basic terms are: acid trail is a two-dimensional horizontogram, describing changes in the pH of salt and water extracts, and the degree of saturation with bases (V) in the acidity field along profile horizons; the ordinate of the graph is the pH of the salt extract (upper line) and the pH of the aqueous extract (lower line) along the horizons; the abscissa of the graph is a dimensionless variable V ; the distance between the curves in the ordinate is the value of ΔpH .

The purpose of research: to determine the acid trail in different types of soils. Objects: mountain soils on the Northern Baseg mountain (western macro slope of the Middle Urals, the Basegi reserve). Acidity was determined by generally accepted methods in a laboratory at the Department of Soil Science of Perm SATU. V -charts were constructed for 3 types of soils that are formed in different conditions: Podzols Rustic (PZrs) (tundra belt, 950 meters above sea level); Cambisols Dystric (CMdy) (meadow, undergoltz belt, 613 m); Cryosols Histic (CRhi) (light forest park, 518 m); Cambisols Dystric (CMdy) (mountain forest belt, 430 m). The soil cover varies for different altitudinal vegetation zones of the Middle Urals, but despite this, all soils are characterized by an acidic reaction of the environment.

Soils have low V values and acid traces are located almost entirely on the left side of the diagrams. In Podzols Rustic (PZrs), the degree of saturation with bases decreases with increasing pH. In the park light forest on the flattened part of the slope, where drainage is difficult, Cryosols Histic (CRhi) is formed, in which the acid trail remains almost unchanged with an increase in V . In Cambisols Dystric (CMdy) in the mountain forest belt, an acid trail is located in the upper right part of the acidity field. Sharp changes are noted on the border of the sections of humus and structural-metamorphic horizons.

Analysis of V -diagrams revealed typical and individual differences of mountain soils in soil acidity and local manifestations of the soil-forming process.

Keywords: mountain soils; soil acidity; acid track; reserve.

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Natural characteristic, problems and potentials of Montenegro

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Abstract

Montenegrin territory is an area with exceptional natural values. Forests covers about 59,9% of the whole territory, and despite the fact that hydrographic conditions varies from waterless areas without springs and surface watercourses, to the areas rich in water, Montenegro as a whole belongs to the group of the water-rich countries. Biodiversity and protected areas are significant Montenegro's potential. These natural potentials and awareness of its preservation have been the sources and drivers for the Declaration on Montenegro as an Ecological State. Sustainable management of natural resources and prevention of its excessive exploitation and degradation is the main goal of the development of Montenegro, proclaimed as an ecological state. Having in mind problems with which Montenegro is faced in its efforts to implement structural reforms and start a new development cycles, these requests of sustainable development represents a huge challenge for the entire Montenegrin society. The interacting and mutually reinforcing processes of technological changes, migrations and urbanization contribute to over-exploitation of ecosystems through complex feedbacks that have important implications for sustainable resource use. This study should highlight some of the key points in relation to this. Our responsibility and obligation is to successfully overcome this challenge, for the coming generations and global-ecosystem, where we contribute a little in surface area, but with valuable part in the content. All for the preservation of the beauty and richness of the nature in our Country.

Key words: biodiversity, protected areas, natural resources, prevention, degradation, ecological state.

Prediction of Runoff Modeling Using Model Tree and Genetic Programming Models

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Abstract

Stream flow model including rainfall-runoff and river flow models have an important role in water resources management. For this reason, in this paper it has been used two famous models hence model Tree (M₅) and Genetic Programming (GP). GP is able to systematically explore many alternative model structures of different complexity from available input and response data that has been found suitable for processing rainfall-runoff and opened various approaches in hydrological modeling. In addition, model trees are as new soft computing method and generalize the concepts of regression trees and they are very capable and efficient so that today in various fields of hydrology and water resources, particularly in matters of classification and prediction remarkable transformation can use a lot. To forecast daily discharge in Kasilian watershed in IRAN country from 1970-1971 to 2011-2012. Some variables such as precipitation, temperature, evapotranspiration, relative humidity and discharge in daily time scale over 42 year period were considered while 40 different scenario structures were assessed for river flow prediction. The results showed that the best model in both M₅ and GP was model number 37. In addition between M₅ and GP, GP has much better performance so that based on statistical criteria such as MSE, RMSE, and MAE and errors rang were 0.001, 0.030, 0.010 for training stage and 0.001, 0.023, 0.005 for testing stage respectively.

Key Words: Genetic Programming, Kasilian watershed, M₅ model, Rainfall-Runoff, Iran

Monitoring and analysis of the geodiversity and biodiversity status of the Skadar Lake

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Abstract

Both minor and wider area of the Skadar Lake is known for its natural value. The rich biodiversity of the greatest wetlands on the Balkans, is not only important for Montenegro and the neighbouring Albania, as a Lake is on their territories, but has a much greater significance for the region, entire Europe, and even wider. Precisely for this reasons, the Lake was the subject of great number of research and other activities when it comes to researching and monitoring geodiversity, and especially biodiversity of this area. The fact that this Lake is under protection of Ramsar Convention since 1995 speaks to significance of Skadar Lake, and Montenegro declared this are a National park earlier in 1983, while the Albanian Government gave this area the status of Nature Reserve in 2005, as a wetland of international significance.

Key words: Skadar Lake monitoring, status of geodiversity and biodiversity, preservation, Skadar Lake basin

Fauna of Amphipoda (Crustacea) within the protection and valorization of Lake Skadar drainage system

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Abstract

The carstic lake Skadar with its fluctuate surface of 370-530 km², situated in western part of Balkan peninsula is divided between Montenegro and Albania. Apart from various small torrents, two large rivers, Morača in Montenegro and Drim in Albania, flows into the Lake, and Bojana river runs off the Lake into Adriatic Sea. The Lake itself is not very old, probably of Quaternary age, but its drainage system is old, of Tertiary age. For this reason, the fauna of Skadar Lake drainage system is mainly of Tertiary origin and remarkably endemic, including Crustacea Amphipoda.

Fauna of Amphipoda of Skadar Lake drainage system is presented by over 22 species belonging to several genera from epigeal and subterranean waters. Among them there are endemic genera and species: *Laurogammarus scutarensis* (Schaferna 1922), *Hadzia crispata* G. Kar. 1969, *Bogidiella montenigrina* G. Kar. 1997, *B. glacialis cataracta* G. Kar. 2002, *Gammarus pljakici* G. Kar. 1964, *Niphargus zorae* G. Kar. 1967, *N. vranjinae* G. Kar. 1967, *N. occultus* G. Kar. 1998, *N. carcerarius* G. Kar. 1987, *Synurella intermedia montenigrina* G. Kar. 1974, *Accubogammarus albor* G. Kar. 1973, etc. as well as several endemic species of western Balkan fauna (*Metohia carinata* Absolon 1927, etc.).

All kinds of protection and valorization of Skadar Lake and its drainage system, must take in consideration preservation of these numerous endemic species and genera of amphipoda as well as entire biodiversity of these epigeal and subterranean waters.

Key words: Fauna of Amphipoda, protection, valorization, Lake Skadar, drainage system

Application of LiDAR data for assessment of river basin boundaries

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Abstract

River basins host a variety of processes that affect the anthropological factors that within a few decades make changes in the river basin boundaries and dividing lines. A few decades ago established basins may differ from the current situation. The designing of various water facilities in most cases need to be performed with hydrological calculations, so it is very important to have the most accurate catchment area of watercourses and length values. Technological developments have made it possible to remotely collect large amounts of data and processing them using geographic information systems (GIS), which make it easier to determine the boundaries of the river basin, flow lines and other parameters. The objective of this study was to clarify the possibility to use LiDAR data setting the boundaries of river basin and watercourses lengths.

The study area incorporates the land area drained by the Dievogala River (basin area 57 km²), which empties into the Nemunas Basin in Kaunas district, Lithuania. The Dievogala River was selected, in part, because the pronounced drainage pattern provides excellent opportunities to explore the delineation of higher order watersheds. The software package ArcGIS and tool Arc Hydro was used throughout the analysis of this study.

Modeling with ArcHydro tool depending on the relief has been set dense network of watersheds (1x1 m in size), which resulted in a larger number of sub-basins. However, the comparison of the total area of sub-basins shows a small difference only 1.1%. Total simulated length of watersheds of Dievogala basin – 15,19 percent less; the length of Dievogala river – 11,27 percent less, total catchment area of Dievogala river – 1,8 percent larger. Comparing the rivers cadastre data with the obtained with ArcHydro tool, it can be argued that the resulting difference is not significant.

To sum up the whole analysis, it is important to mention that in order to determine the exact boundaries of the river basin or to analyze other parameters of the basin, in unclear locations it is necessary to compare the data obtained with the data from other databases.

Key words: *LiDAR, GIS, hydrographic network, river catchment area*

Planning the sowing structure applying optimization models

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Abstract

The selection of agricultural plants for sowing and planning the economic success in production is done in conditions of uncertainty and high risk. The factors, which cause the biggest uncertainty in achieving returns in agricultural production, can be quantified by the valuation method.

The sense, value, manner and process of decision-making problems are determined by the cultural, social, temporal, value, as well as logical context. Fuzzy logic was developed more than five decades ago. The characteristics of fuzzy logic include operating by fuzzy notions, imprecise authentication tables, and fuzzy inference rules. All these characteristics of fuzzy logic are highly important, especially if we try to exchange or supplement the long-dominating approach of decision making in agricultural management with the descriptive one. The criteria, limitations and performances of measures of alternatives bear in themselves some aspects of indefiniteness: in determinativeness, multiple aspects of meaning, incompleteness and fuzziness.

Operational research offers optimization models aimed at finding an activity programme that will yield the best possible results. The models use precisely determined and known data. Constraints are also precisely determined, and the goal function is clearly defined, so that it can be formulated easily and simply.

Reality, especially in the agricultural production, however, is different: very often we lack precise information on the value of individual input parameters, or the values of coefficients in constraint and goal functions, and imprecise formulation of limitations themselves is possible as well.

This paper presents the valuation method at planning the structure of sowing: wheat, chamomile and mint.

Key words: factors for achieving returns, valuation method, fuzzy systems.

Climate change and relieved irrigation water payment conditions in Bulgaria

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Abstract

Many recent model studies have established climate warming and drought in the territory of Bulgaria. A new Ordinance of the Council of Ministers on water consumption in agriculture was published in 2017, in which the reference values of the irrigation depths of 33 irrigated crops were increased by considering the changed climate conditions and their increasing evapotranspiration. Through the new water consumption standards, a new basis of the preferential water prices formation, more favourable for the farmers, was established. It also has the effect of allowing adequate water supply for the fields and impeding the rational management of the water resources. This paper presents the scientific foundations of the update of 33 crops' irrigation depths. Long-term trends of the air temperature, vapor pressure deficit and reference evapotranspiration were statistically proven. Daily 1971-2010 weather data of 40 agrometeorological stations were processed. Mann-Kendal test was used for trends detection. De Martonne Aridity Index was used for characterization of the climate per months in different climatic zones. The distribution of the reference evapotranspiration (1981-2010) in the agricultural territory and its 30-year increase was mapped by using ArcGIS software. The increase of the reference evapotranspiration was determined by multi-regression analysis. The net irrigation depths were updated for moderately dry and very dry year through relevant coefficients that reflect the 30-year increase of the reference evapotranspiration. They were categorized for six agro-climatic zones in the agricultural territory of the country. Gross irrigation depths were calculated according to the efficiency of different irrigation technologies. The list of stations belonging to the agro-climatic zones was composed on air temperature basis. The proposed irrigation depths will be used for establishing up-to-date standards for irrigation systems design and for setting practicable water consumption standards in plant production according to the changing climate of the country.

Keywords: climate change, reference evapotranspiration, De Martonne Aridity Index, irrigation depth

The frequency occurrence of the drought in Montenegro in the period from 1981 to 2017

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Abstract

Period from 2000-2017 in Montenegro characterized extremely climate and drought events. The Institute decided to upgrade the analysis of the drought in Montenegro: on the local, national and regional level. To this initiative contributed IPA INTERREG project Drought Risk in the Danube Region. The analysis are based on standard statistical methods used in Institute of hydrometeorology and Seismology of Montenegro, but also available remote sensing data, methodologies in use of DMCSEE project, all compared with media sources and specific web sites specialized in climatological matters. The purpose of this report is to give an overview on the drought frequency occurrence emphasizing the fact that the drought has to be considered as an issue of high priority.

Key Words: drought frequency, remote sensing data, drought high priority issue

Using the NDVI index to assess the self-growing rates of coal mines dumps

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Abstract

In article are being research the composition and rate self-overgrowing of vegetation on the surface of the coal dumps of the Kizelovsky basin in Perm Territory. The waste dumps of the Kizel coal basin are disturbed landscapes where processes of self-overgrowing of vegetation are taking. The objects of research are coal dumps of mines in the territory of the city district Gubakha. The purpose of the work is to study the nature and rate of self-overgrowing of coal mines dumps in the territory of the urban district of Gubakha using data from Earth remote sensing. The studied dumps form a chronosery from 18 to 45 years from the moment of the end of their dumping. A total of tree objects were studied: "Stone Flower" - 45 years, "Krupskaya" - 24 years, "Central" - 18 years. The study period: from 2010 to 2017. Landsat series of high resolution images and Digital Globe highly detailed images were used to obtain information on the intensity of vegetation overgrowing by coal dumps. The processing of satellite images was carried out on the basis of the QGIS geographic information system and the ISODATA cluster analysis method in the MultiSpec program. The contours of the vegetation are highlighted by the method of uncontrolled classification of highly detailed images of the Digital Globe. The number of classes for cluster analysis ISODATA was selected based on field observations. A total of 3 classes were assigned: Class 1 - the open surface of the coal dump, Class 2 - grassy vegetation, and Class 3 - woody vegetation. Grassy vegetation significantly dominates in the structure of vegetation cover. It takes on average from 33 to 61% of the total area of the investigated dumps. This is established on the basis of calculating the area of the selected classes, which were set for each type of vegetation. The assessment of the status of the selected types of vegetation is given on the basis of the spectral index NDVI. The state of vegetation on the surface of the dumps on the vegetation index is sparse (from 0.4 to 0.5) and good (from 0.6 to 0.7). For the background vegetation located around the dumps, the NDVI values were higher: from 0.69 to 0.72. When combining the contours of the vegetation dumps and the values of the NDVI vegetation index, the open plots of the dump were reliably distinguished. The values of the vegetation index of the open surface varies from 0.01 to 0.273.

Keywords: coal damp, self-overgrowing, NDVI index, remote sensing data.

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Oil losses with the cellulose-based filtration cake during winterization process of sunflower oil

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Abstract

Sunflower oil contains waxes, esters of fatty acids and fatty alcohols. Waxes have a higher melting points and when the oil is stored at low temperature they crystallize and form a turbidity. Waxes are removed from the oil by winterization and filtration or centrifugation or by combination of them both. In filtration process it has been used filter aids to improve flow rate and extend the time of filtration cycle. For filtration of sunflower oil were used different filtration aids based on cellulose, one filter aid improved for precoating and two types of different particle size for distribution during the filtration process. Filtration were taken place on horizontal leaf filters. At the end of filter cycle, filter cake has been formed on the filter plates. Filter cake consists of a mixture of filtering aids, oil and waxes. In this work content of filter cake were analyzed and also content of waxes in oil before and after winterization and filtration. In examined sunflower oils before filtration content of waxes were 295 to 549 mg/kg. After winterization content of waxes in oils were 2.94 to 3.21 mg/kg. In filter cake content of oil and waxes both were 49.7 to 55.3%, content of waxes were 22.05 to 33.1%. Aim of this work was to analyzed oil losses after filtration. Oil losses after filtration are calculated according to content of oil and waxes in the filtration cake in relation to the total amount of oil passing through a filtration cycle. Oil losses per one filtration cycle were 0.203 to 0.439%. This results are very useful in practice because it can be established relation between content of waxes in sunflower oil before filtration and oil losses at the end of filtration cycle.

Keywords: sunflower oil; waxes; crystallization; filtration; filtration aids

Acknowledgments: This work is the result of research under the project TR 31014, financed by the Ministry of Education, Science and Technological Development of the Republic of Serbia.

Filtration process in production of edible refined sunflower oil

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Abstract

By increasing the content of biologically valuable components in sunflower oil, there has been an increase in the amount of undesirable components that are separated by the process of oil refining. These components make the process of refining more or less difficult, increase oil losses and, most importantly, have a negative effect on the quality of the edible sunflower oil. These are phospholipids, free fatty acids, pigments, heavy metals, pesticides, PAHs, pigments, waxes, primary and secondary oxidation products etc. The composition of the non-glyceride constituents (unsaponifiable matter) in sunflower oil varies depending on the type of seeds and waxes, as one of them require a special refining phase called winterization. The winterization represents a simple, but essentially complex and long-lasting refining phase, which aims to remove waxes from the oil. There are several ways of carrying out the winterization process and new solutions are still found. Since there is high content of unsaturated fatty acids, the sunflower oil rapidly becomes the subject to oxidation, and not only should the care of the removal of waxes and certain triacylglycerol, as a cause of oil blur, be taken but the care should, also, be taken of the quality of the oil obtained after the winterization. During the synthesis, the sunflower oil passes through the stages of gradual cooling and then it is filtered. Filtration is a complex technological operation which implies a separation process where solid particles are separated from the liquid medium, most often with the addition of the filtration aids. In general, the oil filtration is not a simple operation, while the oil filtration after the wax crystallization represents a problem that can be seen from several aspects. These are the reasons that led to the final work on this topic. The aim of the paper will be to look at the problem of oil filtration in the production of the edible sunflower oil, based on the latest literature data, with a special emphasis on oil filtration during the winterization.

Keywords: sunflower oil; waxes; crystallization; winterization; filtration aids

Acknowledgments: This work is the result of research under the project TR 31014, financed by the Ministry of Education, Science and Technological Development of the Republic of Serbia.

The Effect of Geological Formations on Groundwater Quality Using GIS Integration and Boolean Logic, Case Study: Emamzadeh Watershed Jafar Gachsaran

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Abstract

One of the main sources of water supply in most parts of Iran is groundwater aquifers that has been affected by various natural and human factors in recent decades. natural factors include geological formations and rainfall reduction in most of the areas. In this research, qualitative study of groundwater resources and their relationship with geological formations were considered. for this purpose, geological formations were extracted using geological map of the region. Then, the qualitative data of 40 wells and piezometric wells were introduced into the chemistry software in order to determine the type of water in the area. then, geological formations were classified according to their ability to produce their brigades and their dissolution (quality); in the next stage, buffers were created at intervals of 1, 3, 5, 7 and 10 km around the wells and their layers with geological maps of the cut given. the results of t-test showed that with probability of 95%, at 1, 3, 5 and 7 km intervals of wells, the percentage of impacts on wells was significant, but at a distance of 10 km and with increasing distance , This effect was less and not significant, but the effect of the sum of non-carbonated formations on the wells increased. the results of the Boolean logic also showed that the formation (Qt2) is most expanded near the wells, which includes young coniferous conifers and sediments, and is the main source of aquifer feeding. But as the distance from the wells increases, the effects of non-carbonated formations such as Asmari limestone and Gachsaran Formations, which have the potential to produce carbonate and chlorine hydrocarbons, are added.

Key words: Geological Formations, groundwater quality, GIS, Emamzadeh Watershed Jafar Gachsaran

The Energy-Smart Public Building in Novi Sad

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Abstract

Since the Building Sector is responsible for 40% of global energy consumption and 30% of GHG emissions. The aim of this work was to present one project energy-smart public building in the city of Novi Sad, whose construction implemented on a global scale would be significantly reduced energy consumption and GHG emissions. The basic advantages of this smart building are reflected in the energy sense (savings in heating, cooling and lighting of the building) and ecological (significantly reduced CO₂ emissions in the atmosphere, decrease in radiation intensity, better rainwater retention, etc.).

Keywords: energy, smart public building, renewable energy sources, GHG emissions

Application of solar energy in irrigation of agricultural crops

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Abstract

The Western Balkans, where Serbia and Montenegro belong, have favorable climatic conditions for successful agricultural production, except that the amount of precipitation in the period of vegetation is insufficient or uneven, which is a limiting factor of high yields and stable production. Drought is present in this region almost every year with a lower or higher intensity, which influences the yield variation. In such conditions, the application of irrigation should be mandatory, because of increasing of the yield and it contributes to more productive use of natural resources and sustainable competitiveness of agricultural production. Irrigation systems consume a large amount of energy, which is mainly provided by electricity or diesel. Diesel as the energy source is most used in irrigation. It is very expensive and polluting the environment. Electricity is usually not available on remote sites of the settlement, and its networking is very expensive. Solar energy is most perennial in irrigation for several reasons. It can be used on lots irrespective of the size, shape and location of the plot. It is more economical compared to other energy sources and is ecologically cleaner.

Solar energy is used in irrigation systems for pumping water, where the conversion of sunlight through photovoltaic cells turns into electricity; Solar energy is in most cases cheaper than other sources of energy. This study presents a set of measures that might help in reducing the level of GHGs emission and protect the environment. Reducing use of fossil fuel and non-renewable energy resource and application of sufficient irrigation systems by efficient use of water resource are essential in order to achieve low carbon footprint, environmental challenges, and also sustainability of agricultural production systems.

Key words: irrigation, precipitation, drought, solar energy, photovoltaic conversion,

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The influence of foliar fertilizing on the yield of some almond cultivars grown in Valandovo

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Abstract

The effect of fertilizing on the yield of *ferenjez*, *texas* and *primorski* almond cultivar grown in Valandovo region in the period from 2012 to 2013 was determined. The experiment was set in four variants and three repetitions. The variants were: Control (untreated); Ever green with Me (55% organic matter, 2% w/w Mg, 2% w/w Fe, 2% w/w Zn, 2% w/w Mn, 0.5 % w/w Cu, 0.5% w/w B); Biolinfa (34% organic matter 3% N, 5.80% K₂O) and Oligomix (1.20% B, 0.10% Cu, 4% Fe, 1.50% Mn, 0.10% Mo, 2% Zn). The distance of fruit planting was 4.5 m row by row and 3.5 m in the rows. In each cultivar, variant and repetition 20 plants were included and total in all experiment were involved 240 plants per cultivar. Three foliar treatments were applied with given above fertilizers at a concentration of 0.4%. In the end of the November, soil fertilizing with the fertilizer Polyfeed 11-44-11+ME (Fe, B, Zn, Mn, Co, Mo) in quantity amount of 450 kg/ha was done. Before setting up the experiment, soil agrochemical analyses were made. So, good fertility with nitrogen and potassium was concluded and medium fertility with phosphorus. The foliar fertilizing had a positive influence on the yield of observed almond cultivars. The highest average content of almond fruit's yield (2794 kg/ha in the *ferenjez* cultivar, 2699 kg/ha in the *texas* cultivar and 2781 kg/ha in the *primorski* cultivar) and the highest average yield of kernels (1079 kg/ha in the *ferenjez* cultivar, 1333,50 in the *texas* cultivar and 1257,30 kg/ha in the *primorski* cultivar) were determined at the variant 2 treated with the fertilizer Ever green with Me (55% organic matter, 2% w/w Mg, 2% w/w Fe, 2% w/w Zn, 2% w/w Mn, 0.5 % w/w Cu, 0.5 % w/w B).

Keywords: almond yield, foliar fertilizing, kernel.

Impact of Climate Change on the Annual Water Balance in a Humid Climate

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Abstract

Lithuania and Bosnia and Herzegovina are considered as countries with high vulnerability and low adaptive capacity to cope with climate change. The entire territory of these countries is characterized by the warming trend, with positive trends in both the maximum and the minimum temperatures throughout the year. The increase in air temperature has resulted in change of evapotranspiration and mean annual water balance values. These countries are also frequently faced with an occurrence of severe droughts and heavy floods. The main purpose of this study was to determine and compare the severity of changes in mean annual water balance for two humid climatic zones, in order to understand how different areas of similar climate characteristics react to climate change and to analyze the significance of their influence. Monthly weather data from two weather stations, Kaunas (Lithuania) and Sarajevo (Bosnia and Herzegovina), for the time period of 30 years (1988 – 2017) were used to determine and analyze the mean annual water balance. The results indicate that climate change has a different effect on the water balance of these two humid areas. Both locations showed a positive trend of reference evapotranspiration, with an increase of 1.450 mm year⁻¹ to 1.503 mm year⁻¹. However, the total runoff and soil moisture deficit are decreasing in Kaunas (-0.480 mm and -2.114 mm year⁻¹, respectively), while they are increasing in Sarajevo (0.492 mm and 0.485 mm year⁻¹, respectively).

Keywords: climate change, water balance, humid climate, Bosnia and Herzegovina, Lithuania

Dynamics of precipitation's acidity at Montenegro area

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Abstract

Institute of Hydrometeorology and Seismology from Podgorica has carried out of annual program of the precipitation quality measurement at entire state area, by sampling and chemical analyzing of 24h-precipitation's samples at the monitoring network in Montenegro. The main ionic species, including pH and conductivity, are implied by physical-chemical analysis of the precipitation composition.

The most important wearers of precipitation acidity, like pH, content of sulfates and nitrates, are included by analysis, which is carried out in the paper. Data about precipitation's acidity in 2000-2017 period are processed, and the review of available data on precipitation acidity in the previous period, is also made.

Analysis of occurrence of the acidity is done on the base of content of the acidity wearers, the frequency of the "acid rains" and spatial distribution of them.

Statistical analysis of the data consistency and mutual correlation of them is carried out. Temporal trends of data series and spatial distribution of "acid rains" analysis related to impact to the ecosystems, are done.

Obtained results shown that the occurrence of the acid rain was the most frequent at the forest area in the north, but the least frequent at Pljevlja region and at southern see coast. Acidity of the precipitations was of the middle range, with the exception of several cases of strong acidity. Frequency and spatial distribution of the acid rains were variable during the measuring period.

Key words: Precipitation composition, acidity, statistical analysis, temporal and spatial distribution

GIS of Habitats of Edible Plants in Transcarpathian Region

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Abstract

The scope of beneficial applications of natural and cultivated plants is expanding all the time. One of the best examples is their use as fundamentally important tools in new P4 medicine. This plant usage (we named it the P4 application) has numerous interrelated aspects that initiate the creation of new information technologies. The latter, include ecology- and epigenetic-related technologies, since the issues of plants ecological cleanliness and differences in their beneficial properties in different localities are extremely important for the P4 application. Therefore, consideration of the ecological and epigenetic aspects of the P4 application is an urgent issue, solution of which requires development of an appropriate territory specific information systems (IS), or rather geoinformation systems (GIS). In this paper, we present the results of developing such a product – GIS of habitats of edible plants in Transcarpathian region. The database (DB) of this GIS contains versatile information, such as botanical characteristics of plants, data on the content of various biologically active components (BACs) in them for each of the studied habitats, as well as spatial information about the habitats. In addition, the DB integrates all available reliable information on the distribution of background values of a) the content of heavy metals, b) the content of selected groups of microorganisms and their antibiotic resistance in the humus layer of soils, and a number of other elements in plants of different habitats. This GIS interacts with a number of other IS, in particular, with our earlier developed GIS of ecological monitoring of surface waters in Transcarpathian region, the DB of BACs of plant origin, and the IS, that we are currently developing to provide the medical aspect of the P4 application. This interaction is able to effectively ensure necessary functionality of these systems, therefore the practical implementation of P4 medicine.

Keywords: edible plants; habitats; ecology; GIS; medicine

Soil distribution in Strumica River basin and its importance for agricultural production

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Abstract

This paper is a result of many years of field and laboratory research of the soils in Strumica river basin, spread out on 148.124,02 ha, ranging from 150 to 1540 m above the sea level in order to gain a better understanding of the productive capacities of the soils and measures for their improvement. The field research of the soils has been done according to methods described by (Filipovski G et al, 1967). In laboratory, the following analyses have been carried out on the soil samples: hygroscopic moisture; mechanical composition; pH of the soil solution; humus content and total nitrogen; content of carbonates; available nutrients P₂O₅ and K₂O. The mechanical composition and chemical properties of the soils have been determined by standard methods described by (Bogdanović et al, 1966), (Mitrikeski & Mitkova, 2001); (Resulović et al, 1971), (Džamić et.al.1996). This area is very heterogeneous, with numerous relief forms, with different expositions and inclinations, and with great differences of altitude. Additionally, there are several geological formations of a very heterogeneous petrographic-mineralogical composition and climate-vegetation zones. Long-term effects from human involvement should also be noted. The vast diversity of the factors required for soil formation in this area is the reason for the formation of many different soil types as well as the lower taxonomic units. These types of soils are characterized by different properties (chemical, physical, physical-mechanical, productive). Therefore, they have varied effects on agricultural production. There are 14 (fourteen) different soil types distributed in the Strumica river basin together with a considerable amount of subtypes, varieties and forms. Mountain soils are prevalent in this river basin: 79.337,6 ha, or (53.56%) of the whole. Soils of lake terraces and of undulated hilly relief cover 30.507,42 ha, (20.59%), whereas soils of colluvial fans occupy 18.739,6 ha (12,65%) of the area. Finally, soils of the plains occupy 17.784,4 ha (12.01%) and Urbisol 1.755,57 ha (1.18%).

Keywords: soil types, Strumica river basin

The conservation of traditional flower gardens plants in Lithuania

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Abstract

In 2001, the Seimas (Parliament) of the Republic of Lithuania adopted the Law on National Genetic Resources of Plants. According to the provisions of this law, the genetic resources of plants, which have ecological, selective and economic value for the Republic of Lithuania, are selected and included into the central database of national genetic resources of plants. Currently, 8 institutions are involved in activities of collection, investigation and conservation of plant genetic resources. Plant Gene Bank with Coordination centres of different plant groups (agricultural plant, forest trees, fruit and vegetables, medical plants and ornamental plants) has been established and operates until now. A group of ornamental plant 25 species of traditional flower gardens plants are included in the National List of Plant Genetic Resources. These plants have been grown in flower gardens in Lithuanian villages from old times. According to their growth time plants were divided into four groups: 1) plants which were grown from 14–15 centuries – 5 species: *Aconitum napellus* L., *Asparagus officinalis* L., *Bellis perennis* L., *Convallaria majalis* L. and *Ruta graveolens* L.; 2) from 16–17 centuries – 8 species: *Alcea rosea* L., *Artemisia abrotanum* L., *Dianthus barbatus* L., *Hemerocallis lilio-asphodelus* L., *Hemerocallis fulva* (L.) L., *Narcissus poeticus* 'Plenus', *Narcissus poeticus* L. and *Vinca minor* L. ; 3) from 18–19 century – 10 species: *Achillea ptarmica* L., *Coreopsis tinctoria* Nutt., *Delphinium elatum* L., *Dicentra eximia* (Ker Gawl) Torr., *Dicentra spectabilis* (L.) Lem., *Lychnis chalconica* L., *Philadelphus coronarius* L., *Rudbeckia laciniata* L., *Symphoricarpos albus* (L.) S. F. Blake and *Tanacetum balsamita* L.; 4) from 20 century – 2 species: *Centaurea dealbata* Willd. and *Polygonatum odoratum* (Mill.) Druce. Now these 25 plant species are grown in the Lithuania's folk museum expositions.

Key words: traditional plants, flower garden, conservation

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Ecological culture and media

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Abstract

Mass media may have an influence and can enrich ecological culture and build up an ecological awareness. Some theoreticians (Gidens) believe that ecological culture could be determinate as a more or less solid system of values and opinions about the environment, the state of resources, the dangers to which the environment is exposed and the concepts of its protection. When it to concern the suitable social development and cultural factors are neglected. Culture plays an important role in defining attitudes, values, behaviour and developing a framework for assessing the impact of culture on the environment. The role of the media in the creation of an ecological culture consist in the constant actualization of environmental threats. It is necessary to constantly redefine the adopted concepts for environmental protection, to regularly report on new scientific, theoretical and practical knowledge in the field of ecology. The paper also focuses on ecological culture through the prism of school programs as well as the educational function of the media that has shortcomings contained in text to much information, lack of necessary selection, the imperative of being first in the broadcast besides, in the quality content of the broadcasted information.

Key words: ecology, media, ecology protection, environment

Tying practices, untying processes

Art and design as environmentally engaged practice

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Abstract

How can butterflies guide us to understand the consequences of rising temperatures? What can scientists and designers learn from each other when looking at changing landscapes? What can we learn from people in rural areas for our urban lives? How can we create environmental narratives out of abstract data?

Artists and designers today are actively engaging in questions about how the world works and potentially could work, collaborating with scientists and communities of different expertise. While data and findings are often discussed among closed circles of experts, an interdisciplinary approach allows for asking different questions, and making abstract processes more accessible to individuals and communities. This creates consciousness, spaces for discussion, opportunities for informed decision making, playful interaction, participation, and possibly change.

In the presentation is presented a a range of interdisciplinary projects from artistic practice and design education in the field of environmental communication.

Key words: Art and design, environmentally engaged practice

The War Crime of Anticipatory Collateral Damage to the Natural Environment - Critical Inquiries into its Anthropocentric Incongruence

(Draft not to be cited)

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Identifying the background condition(s) of the issue to be explored and demarcating the parameters of their implications are essential for any analytical investigations in the disciplines of social science. The law as social construct is 'a cultural medium of expressive form',¹ which should be comprehended as profoundly rooted in a specific spatiotemporal context.²

It might be commented that one of the seminal aspects of the 1998 Rome Statute of the International Criminal Court (ICC Statute or Rome Statute) is its explicit inclusion of a war crime relating to the protection of natural environment.³ Yet, as critics quickly notice,⁴ it is not the environmental damage per se that constitutes an offence under international criminal law. Instead, the Rome Statute's achievement in this regard is limited only to criminalizing the attack against a military objective that causes collateral damage to the natural environment. As paradoxical as it may seem, it is not the damage to the natural environment by a direct attack but the damage incidental to the attack against a military objective that features as a specific crime in the ICC Statute. This is prescribed in the text of Article 8(2)(b)(iv) of the Rome Statute, which is (so far) the only provision that expressly refers to the natural environment. Indeed, Article 8(2)(b)(iv) of the ICC Statute is the conceptually incoherent admixture of two different genres of war crimes that only share the common denominator of anticipated 'collateral damage': The one relating to civilian casualties (incidental loss of lives of civilians, injury to civilians, or damage to civilian objects); and the other on damage against the natural environment.⁵ Under this provision, it is a war crime to launch intentionally an attack 'in the knowledge that such attack will cause...widespread, long-term and severe damage to the natural environment which would be clearly excessive in relation to the concrete and direct overall military advantage anticipated'. This provision includes the (near) identical terms in the relevant treaties of international humanitarian law (IHL), namely, Articles 35(3) and 55 of the 1977 First Additional Protocol to the Geneva Conventions (API), and in Article 1 of the 1976 Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques (ENMOD Convention). Such a modest place occupied by the protection of the natural environment in the ICC Statute should be criticized as evidencing our humanity's continuing failure to address squarely vital

¹ Desmond Manderson, *Songs Without Words – Aesthetic Dimension of Law and Justice*, (Berkeley: Univ. of California Press, 2000), at 201.

² Costas Douzinas and Adam Gearey, *Critical Jurisprudence – The Political Philosophy of Justice*, (Oxford: Hart, 2005), at 248.

³ Surely, under Article 8(2)(b)(ii) ICC Statute, any intentional attack against civilian objects, which can encompass those found in the natural environment, is a war crime based on '[o]ther serious violations of the laws and customs applicable in international armed conflict'. For environmental protection during warfare in general, see Karen Hulme, *War Torn Environment: Interpreting the Legal Threshold* (Leiden: Martinus Nijhoff Publishers, 2004); Richard A. Falk, 'The Inadequacy of the Existing Legal Approach to Environmental Protection in Wartime' in J.E. Austin and C.E. Bruch (eds), *The Environmental Consequences of War: Legal, Scientific and Economic Perspectives* (Cambridge: Cambridge University Press, 2000) 137; MA Drumbl, 'Waging War against the World: The Need to Move from War Crimes to Environmental Crimes' in Austin and Bruch (eds), *ibid.*, 620; and Michael N. Schmitt, 'War and the Environment: Fault Lines in the Prescriptive Landscape' in Austin and Bruch (eds), *ibid.*, at 87.

⁴ See, for instance, Tara Weinstein, 'Prosecuting Attacks That Destroy the Environment: Environmental Crimes or Humanitarian Atrocities?' (2004–2005) 17(4) *Georgetown International Environmental Law Review* 697; and Tara Smith, *Creating a Framework for the Prosecution of Environmental Crimes in International Criminal Law*, (Ashgate, 2013).

⁵ As a result of such a hodgepodge, the war crime based on incidental damage to the natural environment suffers from the incongruence of the elements of crimes. As will be discussed below, this is caused by the introduction of the superfluous qualifying words, which was originally relating solely to the collateral civilian casualties.

environmental concern in the system of international criminal justice. Further, as will be seen below, the concern for the natural environment is undercut by the essentially subjective value-judgment involved in the proportionality appraisal.

There is every reason to criticize that the war crime of collateral damage to the natural environment can be established only in highly limited circumstances. This can be done only where the perpetrators have proceeded with the attack against a particular military objective even though they were aware that such collateral environmental damage would be expected to upset a proportionate balance that ought to be struck between the injury to the natural environment and the speculative military advantage.⁶ More specifically, under the Rome Statute the individual war crimes responsibility may arise only where the 'widespread, long-term and severe' damage to the natural environment would be 'clearly excessive' in proportion to the military advantage anticipated.⁷ For the ICC Statute, a violation of the relevant IHL rule based on 'widespread, long-term and severe damage' to natural environment alone is not sufficient, however grave such damage may be. Perpetrators, though having executed an attack that is likely to cause such potentially catastrophic environmental damage (or even has actually caused the damage),⁸ may be exonerated if presenting the counter-argument based on the overriding military advantage. By subordinating environmental damage to such a balancing process, the ICC Statute manifests how the ecological consciousness of the international lawyers and diplomats lagged far behind the consciousness of the natural scientific community. In contrast, under the API (Articles 35(3) and 55) or the ENMOD Convention, the state responsibility (as opposed to individual war crime responsibility) for the environmental damage can be established solely on the basis of the degree of damage. For this purpose, there is no need for balancing inquiries into countervailing military interests. In that sense, the ICC Statute is a clear setback.

Moreover, the bar for such a balancing is set so high that a judge must be convinced of an exceptional scenario: the perpetrators have proceeded with an attack despite their cognizance that such damage is expected to be 'clearly excessive' in relation to 'the concrete and direct overall military advantage anticipated'. In practice, such a threshold of damage makes the possibility of prosecuting the war crime of collateral environmental damage unrealistic.⁹ The drafting history that explains why such a high bar is placed is also indicative of the scant regard paid to the protection of the natural environment. In the process of drafting the Rome Statute, some powerful Western states led the 'battle' over the choice of the words in relation to the war crime of collateral civilian casualties. They succeeded in having the qualifying words 'clearly' and 'overall' inserted for the very purpose of lessening the risk that their military personnel might be charged for this war crime.¹⁰ The problem is that the war crime of collateral damage to the natural environment is tethered to that of collateral casualties of civilian persons and to that of collateral damage to 'civilian objects'. As a consequence, those controversial words purported to make it harder for prosecuting the latter war crimes end up being 'grafted' onto the element of the former. Such drafting manoeuvring has yielded 'collateral damage' to the ecological movement. Apart from adding uncertainty through the conceptually incongruent concept of 'concrete and direct overall military advantage', it has resulted in the diminished chance of identifying an individual criminal responsibility relating to the incidental damage to the natural environment.

⁶ Put differently, Article 8(2)(b)(iv) ICC Statute can be invoked only where the injury to the environment is found to outweigh the military gains accruing from that attack.

⁷ By comparison, as noted above, for the intentional attack against the natural environment to constitute a violation of IHL and hence to engage the state responsibility, there is no need to appraise the proportionality of the countervailing interests.

⁸ The Preparatory Commission of the ICC Statute decided that this war crime is not based on the actual 'result', but its 'conduct' as such is considered so blameworthy to be criminalised: Knut Dörmann, *Elements of War Crimes under the Rome Statute of the International Criminal Court – Sources and Commentary*, (Cambridge: Cambridge University Press, 2003), at 162.

⁹ See Ines Perterson, 'The Natural Environment in Times of Armed Conflict: A Concern for International War Crimes Law?' (2009) 22(2) *Leiden Journal of International Law* 325-343.

¹⁰ It is the United States that led the initiative in the drafting process to insert the qualifying adverb 'clearly' before the adjective 'excessive' and the qualifying adverb 'overall' to the phrase 'concrete and direct military advantage anticipated'.

As discussed above, in order for the war crime of collateral damage to the natural environment to materialize, a perpetrator must evaluate *ex ante* the factual circumstances and come to the conclusion that the damage to the environment would be excessive. Subsequently, *ex post facto*, the prosecutor and the judges must evaluate the perpetrator's value-judgment based on 'the requisite information available to the perpetrator at the time'.¹¹ While the first process is predicated on a subjective value-judgment, international criminal lawyers argue that the second process is supposed to be 'objective' evaluations by the judiciary (while taking into account the circumstances at the material time)¹². Yet, such a supposedly 'objective' evaluation itself is a suspicious and contestable concept. International judges are inculcated with diverse *a priori* values.¹³ This may result in their different value-judgments in evaluating the meaning and implications of the key elements of the two overall opposing interests (namely, the collateral injury to the environment; and the military advantage).¹⁴

Further, the judges' effort to acquire the perpetrator's 'knowledge' of anticipated environmental damage at the material time is marred by 'legal technical' issues. To the dismay of legal advisors (and no doubt to the natural scientists!), the drafting records show that different meanings are ascribed to three elements that are nevertheless almost identical in the two relevant treaties: 'wide-spread, long-term and severe' in the API, as compared with 'widespread, long-lasting or severe' in the ENMOC Convention. For instance, the temporal scope implied by the adjective 'long-term' in the API is decades-length. Yet, the comparable adjective 'long-lasting' under the ENMOC Convention is understood as equivalent to 'a period of months or approximately a season'.¹⁵ Faced with such incoherence in the meaning attached to the near identical terms, how can a perpetrator (above all, a commander) be judged to harbour a requisite degree of knowledge about the temporal ambit, geographical scope and material degree of the anticipated collateral damage to the natural environment, and even about the relative weight of such damage in proportion to the gain in military advantage?

This paper will engage in critical appraisal of how the anthropocentric military rationales that underlay the drafting of the ICC Statute have resulted in undermining the vital environmental concern. Needless to say, to avoid normative disorder of international criminal justice,¹⁶ it is essential that there be clear guidance for ascertaining the perpetrator's awareness of the degree of environmental damage that is speculated to arise incidentally. Yet, such an endeavour to obtain as 'objective' a standard as possible proves to be, if not fruitless, all the more elusive. It would be stuck in the conundrum of how to extrapolate 'objective knowledge' that is constructed and systematized by our subjective sense-data.¹⁷

¹¹ Footnote 36 attached to the Elements of Crimes concerning Article 8(2)(b)(iv) of the ICC Statute.

¹² Dörmann, *supra* n. 6, at 165.

¹³ In this regard, to what extent can such judge's *ex post facto* evaluation can be approximated to 'objectivity' of the kind that the post-Enlightenment natural scientists have assumed as their basis for their inquiries?

¹⁴ One may include knock-on effect of the collateral damage that may materialise in the long-term while others may be ready to take into account geographically remote and long-term military advantage in the wording 'overall'. For more in-depth inquiries, see ICRC, *The Principle of Proportionality in the Rules Governing the Conduct of Hostilities under International Humanitarian Law* (Geneva: ICRC, 2018).

¹⁵ ICRC, *Commentary on the Additional Protocols of 8 June 1977 to the Geneva Conventions of 12 August 1949* (Geneva: ICRC, 1987), at 416, para. 1452.

¹⁶ Hume, a sceptical philosopher, is said to warn that '[d]isorder arises from the intolerable impossibility of certainty in questions of knowledge and justice, an impossibility whose intolerability seems soluble by the imposition of authority'. See Ian Duncanson, 'Law as Conversation', in Anne Orford (ed.), *International Law and its Others*, (Cambridge: Cambridge University Press, 2009), 57-84, at 79.

¹⁷ To recall, just before his death in 1938, Edmund Husserl wrote that 'the objective-scientific method rests upon a never questioned, deeply concealed subjective ground whose philosophical elucidation will...reveal...the true ontic meaning of the objective world - precisely as a transcendental-subjective meaning': Edmund Husserl, *The Crisis of European Sciences and Transcendental Phenomenology - An Introduction to Phenomenological Philosophy* (1954); translated by David Carr, (Evanston: Northwestern University Press, 1970), at 100, para. 27.

(9) Forestry

Organization of protected area management system in Serbia

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Abstract

The organization of the protected area (PA) management system includes interaction of different frameworks, the structural characteristics of the PA management, and the mechanisms for financing the PA management system. This interaction is carried out at different levels and involves the involvement of various stakeholders in the decision-making process. PA managers in Serbia come mostly from the public sector, but part of the PA management is delegated to the private sector. Considering the fact, that in the following period it is necessary to establish double more areas of PA, the question of the existing organization is raised, as well as the need to improve the existing organization of the PA management system. The aim of this research is to determine the organization of structural characteristics of the PA management and financing mechanisms. The primary data used for this research were collected during 2014-2015 period, through a survey. The results of the research indicates that public enterprises (PE) that manage national parks and PE "Vojvodinašume" in terms of structural components of PA management, show the best results, as is the case with financing mechanisms, unlike other groups of managers. As a proposal for the improvement of the existing management system, it is proposed to improve management and protection, through more efficient cooperation with the users of the area in terms of preparation of the planning documents, organization of the ranger service, more intensive cooperation with the stakeholders in terms of promotion and protection of the PA. It is also proposed to improve the use of national and international financing sources, as well as efficient collection of PA fees.

Key words: organization, management system, managers, structural characteristics, Serbia.

**** Key Note paper / Invited speaker for the Forestry session**

Plant species diversity and structural characteristics of the old-growth spruce-fir-beech forests in Biogradska Gora

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Abstract

Species richness is a fundamental parameter of the site biodiversity potential. Quantifying and comparing taxon richness of mixed forests of spruce, fir and beech (*Piceo-Abieti-Fagetum* Čol. 1965.) is done according to phytosociological studies followed by Braun-Blanquet method. We recorded 41 vascular plant species in four sample plots of the total area of 1 ha. Concerning the plant species composition, we found differences in species richness between mixed forests of spruce, fir and beech and fir-beech forests in Biogradska Gora. Number of species was lower than in the forest community of fir-beech in the same preserved area, but higher than in managed forests of spruce-fir-beech.

The overview of structural characteristics is done according to the data from four clusters. The number of trees per unit area varied from 300 to 445 trees per ha. Estimated values for timber volume were from 558,9 m³/ha to 749,0 m³/ha.

The results presented in this paper have shown that mixed forests of spruce, fir and beech on Biogradska Gora belong to forest ecosystems of high degree of preservation, with high values of growing stock and with a structure that is characteristic of the old-growth forests.

Keywords: old growth forest, mixed forests, spruce, fir, beech, Biogradska Gora

The Automatization of Forest Management Works in Romania using GIS and UAV Photogrammetry

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Abstract

Developing forestry management maps, in Romania, is essential especially in the context of illegal logging. Specialized law requires elaboration of forest management maps to regulate the work of cutting, sanitation, conservation, harvest optimization etc. The area taken into study is around Lake Nistru, Maramureș County, Romania. This study aimed to develop a workflow in order to automate the forest management maps realization and also to highlight the benefits of using digital photogrammetry and GIS techniques. We acquired high resolution data (0.0589 m spatial resolution) using a consumer-grade Unmanned Aerial Vehicle (UAV) having on board a 24.3 megapixels digital camera. By processing the photogrammetric data we obtained a point cloud with a density of 18 points/m² and a digital elevation model with a resolution of 23.6 cm/pixel. By using some GIS spatial analyst tools, we obtained the cartographic support for forest management. We determined the necessary forest management elements: surface, consistency, exposure, medium altitude. For referencing the photogrammetric measurements 8 ground control points (GCP) were used for which we computed the root mean square error (RMSE) related to the spatial coordinates (X, Y, Z): 6.059 cm on X, 3.761 cm on Y and 4.596 cm on Z.

Keywords: Forest management map, GIS database, point cloud, UAV photogrammetry

Climatic niche of *Abies alba* in Montenegro

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We used national forest inventories (NFIs) for silver fir from Germany and Montenegro to model the climatic niches of silver fir of the two regions and for their combination. Our results were supposed to show a) how strong the effect of the datasets is on the modelled niche and b) if Montenegrin provenances of silver fir differ and could contribute to climate change adaptation of German mountain forests. We found considerable differences between modelled niches for Germany and Montenegro. But, we could not find that the Montenegrin ecotype was more drought tolerant than the German one. However, the niche based on the combined dataset was wider than each of the two alone, especially with respect to temperature. This indicated that niche estimations based on the German dataset are not robust in the light of estimating the potential of silver fir for climate change adaptation. We suggest adding the Italian dataset to cover the warm and dry end of the silver fir distribution.

Key words: National forest inventory, climatic niche, silver fir

Value chain types for Non-Timber Forest Products in Macedonia

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Abstract

The overall global notion of Non-Timber Forest Products (NTFPs) has increased awareness of the multiple products and services provided by forests. NTFPs are becoming more popular in present times and have in many countries a larger role among marketed forest products. The basic characteristic of a value chain is market-focused collaboration: different business enterprises work together to produce and market products and services in an effective and efficient manner. Value chains allow businesses to respond to the marketplace by linking production, processing and marketing activities to market demands.

This paper describes which NTFPs were present on the market in Republic of Macedonia, the importance of the products and also the organization and cooperation between the actors in the NTFPs sector (collectors, producers and traders). The method used in this paper is quantitative based on survey data collection and SPSS program was used for data analyses. Collection of primary data for investigated research on market of NTFPs and actors involved in dealing with NTFPs was by survey with two different semi-structured questionnaires, one for companies active in the field of NTFPs (buyers, processors and traders) and one for pickers (collectors) in the field. Marketing mix as a conceptual framework was used for this paper with focus on marketing mix tool: product, price, place and promotion (4Ps). Results showed that in the Republic of Macedonia there are two levels of companies which exist on the market of NTFPs, companies which exports and companies which act as middlemen. Also it can be concluded that there was need for greater amounts of collected NTFPs, because the capacity of companies were utilized only 50%. So, there is greater demand versus supply of NTFPs. The NTFPs sector in Republic of Macedonia is a "supply driven chain" that is characterized by a horizontal based structure driven by local firms and companies which are dependent mainly on private and commercial capital. According to the obtained results, interest of collectors of NTFPs register trends of decline due to the low price of NTFPs, too much time spent on collection, forest fires, etc. On the other hand, NTFPs represent important income for their family budget according to the difficult economic situation in the state.

Key words: NTFPs, market, value chain, companies, collectors

Current Planning of forest management in Serbia

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Abstract

The definition of sustainability is harmonized with pan-European groundwork and is the basis for planning management at the national level. It is the basis of the system of forest management planning. The forest management planning system in Serbia is established by law and basically covers two levels of planning: strategic and operational planning. Strategic (periodic planning organized at the level of the forest area) and operative (periodically and annually) at the level of the MU and the spatial division into lower-order units within them. The essential characteristics of the planning system in relation to the previous concept are integrity and participativity. Integrated management plans include planning that takes into account simultaneously all resource capacities and the needs and requirements of all stakeholders respecting the principles of cooperation, compromise and consensus. The prerequisites for successful planning is participatory approach in the process. One of the conditions for successful negotiation is the competence of the participants in the process. In relation to the typical "planning area under risk conditions", which includes planning for the protection, improvement and utilization of the total natural potential of forests in forest areas that are increasingly unstable due to climatic needs, there has been a need for adaptive planning that is necessarily asymmetric in the case of large damage to the forest time and space. One of the conditions to solve these problems with minor ecological and economic costs is certainly intensive and permanent learning with the practice and specificity of different forms of risk factors.

Keywords: Serbia, forest management planning, integrity, integrity, risk factors, adaptability

Monitoring the condition of woody plants in urban green areas in Lithuania

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Abstract

Lithuania appears at the northern part of temperate climate zone. Green plantations are relevant to urban territories in Lithuania. A Landscape law (14.01.2008, No D1-31), adopted at 1st January 2008, with its program “On the green plantations’ and greeneries’ state monitoring” places problem projections and their solution means under obligation in order to collect data and other information on the green plantations and greeneries at municipality allocated territory for proper status assessment, management and prediction. Non-infectious injuries, fungal diseases and pests’ intensity were rated in grades (0–4 grades system). 6500 (belonging to 57 genera, 98 species, 30 cultivars) in recreational greeneries, and 3300 (belonging to 28 genera, 35 species, 3 cultivars) plants in protected street greeneries were observed.

Plants were more vulnerable to violations of non-infectious origin (defoliation, discoloration, dry branches) during the first year of implantation. The intensity and variety of violations of non-infectious origin was ascertained. Fungal disease agents of 24 genus, 30 species and pest of 16 genera, 19 species injured plants of 29 genera, 37 species, 7 cultivars were detected. Amongst the pests *Cameraria ohridella* had the strongest influence annually on *Aesculus hippocastanum* (up to 2.38 grades), *Acer ginnala* was injured by *Sawadaea bicornis* up to 3.5 grades. Damage intensity of fungal diseases and pests at protective street greeneries was little and injuries of non-infectious origin were found to be stronger than these at recreational greeneries.

Key words: woody plants, state, urban green areas, Lithuania

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Economic Valuation of Forest Ecosystem Services in Canton Sarajevo

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Abstract

This paper deals with economic valuation of forest ecosystem services in Canton Sarajevo in Bosnia and Herzegovina. Obtained results are based upon method of paired comparison that enabled economic valuation of provisioning, regulating and cultural services of forest ecosystems. Total Economic Value - TEV concept and the concept of Ecosystem Services were used as theoretical framework in this paper. Survey among citizens of Canton Sarajevo was conducted in period August-September 2017, and in total 417 respondents have correctly fulfilled the questionnaire. The regulating ecosystem services (e.g. climate regulation, water regulation and purification and biodiversity conservation) are considered as most important type of services provided by forests in Canton Sarajevo. On average, these types of ecosystem services are also mostly valued, while calculated respondents' willingness to pay was in interval from 545,25 to 791,46 BAM. Provisioning services (e.g. provision of industrial wood, firewood and non-wood forest products) are next, based upon importance, while economic valuation revealed that average willingness to pay was in interval from 311,67 to 708,67 BAM. Cultural ecosystem services (e.g. continuous education on sustainable forest management and different forms of touristic activities) have had the lowest rates of importance, as well as respondents' willingness to pay, that was in interval from 121,24 to 691,72 BAM. Based upon importance and economic value of forest ecosystem services, recommendations for creation of forest policy instruments were created. Forest policy instruments for integration of economic valuation in decision-making process were divided into two categories – general and specific forest policy instruments. One can conclude that economic valuation of forest ecosystem services needs to be incorporated in forest management activities and planning process in Canton Sarajevo. Identified and analyzed attitudes of citizens toward forest ecosystem services can serve as basis for creation of innovative and transparent PES mechanisms based on participation of all stakeholders.

Keywords: Economic valuation; Ecosystem services; Forest policy instruments; PES mechanisms