# SCIENTIFIC DI STUDENTS





NITRA SLOVAK REPUBLIC

SLOVAK UNIVERSITY OF AGRICULTURE IN NITRA



### SUA · FHLE Faculty of Horticulture and Landscape Engineering



SUA·FBFS Faculty of Biotechnology

and Food Science

SUA·FAFR Faculty of Agrobiology and Food Resources

# BOOK OF ABSTRACTS

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### SLOVAK UNIVERSITY OF AGRICULTURE IN NITRA





SUA·FBFS Faculty of Biotechnology and Food Science



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## Scientific Conference of PhD Students of FAFR, FBFS and FHLE SUA in Nitra with international participation

**Proceedings of abstracts** 

on occasion of the Science and Technology Week in the Slovak Republic



9<sup>th</sup> November 2023 Nitra, Slovak Republic

# Scientific Conference of PhD Students of FAFR, FBFS and FHLE SUA in Nitra - Proceedings of abstracts

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#### Preface

The ability to do scientific research is one of the most wonderful gifts that humankind has ever received. It is a combination of challenge, adventure, excitement, failure, victory and humility - like life itself. Scientific research serves humanity, and service to others is the highest form of human existence. But more ... thinking about serving in the field of feeding the world ... one must be proud ...

By opening this book of abstracts, to which you have contributed with your works, you become direct participants of the materialization of one of the basic human qualities - curiosity. It is curiosity that conditions our desire for knowledge, and this, in turn, goes hand in hand with the search for answers to the questions that have arisen ... and scientific research is one of the areas where the search for answers is the essence of this activity.

The main aim of the Scientific conference of PhD. Students of FAFR, FBFS and FHLE is to provide a platform for expression, sharing and discussing your scientific knowledge. Abstracts in this proceeding were split among the four areas covered by conference:

- Biotechnology
- Animal production
- Applied and molecular biology
- Nutrition
- Multifunctional agriculture, environment, landscape architecture and rural development
- Plant production
- Technology, quality and safety of raw materials and foodstuffs of animal origin
- Technology, quality and safety of raw materials and foodstuffs of plant origin

The Scientific Conference of PhD Students is organised at the Slovak University of Agriculture in Nitra on occasion of the Science and Technology Week in the Slovak Republic under the auspices of prof. Ing. Marko Halo, PhD. – dean of the Faculty of Agrobiology and Food Resources (FAFR), prof. Ing. Norbert Lukáč, PhD. – dean of the Faculty of Biotechnology and Food Sciences (FBFS) and prof. Ing. Dušan Igaz, PhD. – dean of Faculty of Horticulture and Landscape Engineering (FHLE).

We believe that the Conference has encouraged the further advancement through fruitful discussions among students and other participants; and that the scientific programme has contributed to increasing the knowledge, improving the future work, and building new friendships between PhD students from different countries and from the broader spectrum of biological sciences.

prof. Ing. Marko Halo, PhD. Dean of FAFR

prof. Ing. Norbert Lukáč, PhD. Dean of FBFS

prof. Ing. Dušan Igaz, PhD. Dean of FHLE

### SECTION

### Biotechnology

#### Potential use of algae extract as bioagents

#### Natália ČMIKOVÁ

Supervisor: prof. Ing. Miroslava Kačániová, PhD.

More than 70 % of the Earth is covered by the ocean, which is home to seaweed and algae. The ocean provides many unique environments and rich resources with great potential to produce bioactive compounds. Some seaweeds can be ready for harvesting after only 6 weeks and the Giant kelp can grow 60 centimetres per day. This offers us almost unlimited potential for the use of seaweed in all industries. Seaweed extracts are gaining more and more interest due to their unique composition and potential for wide industrial applications. Algae and algae extracts are also useful for agricultural applications as biofertilizers and soil conditioners to improve soil fertility, plant productivity, and disease control. Therefore, in our work we focused on the production of ethanolic and aqueous extracts of macroalgae (kelp, dulse) and microalgae (Nannochloropsis spp., Tetraselmis chuii, Thalassiosira weissflogii, Chaetoceros muell, Chaetoceros muelleri, Tisochrysis lutea, Chlorella yulgaris, Arthrospira platensis) and tested their activity on plant microorganisms that show synergistic effect on plant growth (grampositive bacteria Bacillus subtilis, Bacillus megaterium) and antimicrobial effect against plant pathogens (gram-negative bacteria Pectobacterium (Erwinia) carotovorum, Pseudomonas syringae). Algae was purchased in powder form from Proviron (Belgium) and Futunatura (Slovenia) from which aqueous and ethanolic extracts were prepared. The effect of algal extracts on bacterial growth and inhibition was determined using disk diffusion method. Ethanol, water and ATB (meroprene) were used as positive and negative control. The aqueous extract of Nannochloropsis microalgae and the aqueous extract of T. chuii showed inhibitory activity (zones of inhibition) against plant pathogens (1.89-2.33 mm) but on the other hand, they promoted the growth of B. subtilis and B. megaterium (0.00 and 0.00 mm). This could lead to the possible use of algae in agriculture as both protection and fertilizer, since extracts of algae inhibited only pathogenic bacteria, and *Bacillus* spp. did not.

#### Keywords: algae, seaweed, Bacillus spp., plant pathogen, antimicrobial activity

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**Contact address:** Natália Čmiková, Institute of Horticulture and Landscape Engineering, Slovak University of Agriculture, Tr. A. Hlinku 2, 949 76 Nitra, Slovakia, n.cmikova@gmail.com

#### Scientific Conference of PhD Students of FAFR, FBFS and FHLE SUA in Nitra – Proceedings of Abstracts SECTION **Biotechnology**

#### Study of genetic diversity of common bean using Random Amplified Polymorphic DNA

#### Zuzana HROMADOVÁ, Lucia MIKOLÁŠOVÁ, Zdenka GÁLOVÁ

Supervisor: prof. RNDr. Zdenka Gálová, CSc.

Common bean (Phaseolus vulgaris L.) is a legume very important in human nutrition. It provides necessary source of proteins, carbohydrates, vitamins and minerals, especially for many people in the developing countries. The study of genetic diversity of the common bean genotypes, using different molecular markers, provides the information on their genetic background, as it expresses the degree of genetic variability between genotypes. Such information is useful for the application in breeding programs and the marker-assisted selection, which leads to the production of bean varieties with improved traits. Currently many molecular methods are available for the genetic studies of genetic diversity of plants. Random Amplified Polymorphic DNA (RAPD) is frequently used type of PCR-based molecular marker technique suitable for the studies of genetic variability in crops. The main goal of the present study was to analyse genetic diversity in the set of 33 common bean genotypes, from different countries of origin, using six RAPD markers (OPA-02, OPA-09, OPC-01, OPC-04, OPD-18, OPE-01). Genomic DNA was extracted from young seedlings of beans. Isolated DNA was used for the amplification of DNA fragments using polymerase chain reaction. A total of 62 DNA fragments were amplified, of which 49 fragments (79%) were polymorphic and 13 fragments (21%) were monomorphic. Based on the selected primer, the percentage of polymorphism varied from 50% (OPC-01) to 100% (OPC-04). The average percentage of polymorphism was 78.04%. The size of the amplified PCR products ranged from 100 to 2000 bp. Values of polymorphic information content (PIC), which express the level of markers' effectivity, were used to evaluate the DNA polymorphism in the set of bean genotypes obtained using RAPD markers. The PIC values ranged from 0.515 (OPC-01) to 0.872 (OPD-18), with an average value 0.768. From the obtained binary data, the dendrogram of genetic relatedness of genotypes was prepared based on hierarchical cluster analysis using UPGMA algorithm. Genetic similarity between genotypes was measured using the Jaccard index. The dendrogram divided 33 analysed common bean genotypes into two main clusters based on their genetic similarity. Each main cluster was further subdivided into subclusters. The most genetically similar were genotypes Alicante originating from the USA and Meteorit of unknown country of origin with the value of Jaccard index 0.897. On the contrary, genotype Fullcrop originating from the USA and genotype Nordstern originating from Germany were genetically the most distant, based on the value of Jaccard index 0.278. According to our results, we can consider RAPD markers an effective tool for the detection of DNA polymorphism, and for the genetic diversity studies and differentiation of common bean genotypes.

#### Keywords: Phaseolus vulgaris L., DNA polymorphism, RAPD, dendrogram

**Acknowledgement:** Work was supported by the VEGA project No. 1/0291/21 (50%); KEGA project No. 026SPU-4/2021 (20%); KEGA project No. 027SPU-4/2021 (20%) and Operational program Integrated Infrastructure within the project: Demand-driven research for the sustainable and innovative food, Drive4SIFood 313011V336, cofinanced by the European Regional Development Fund (10%).

**Contact address:** Zuzana Hromadová, Institute of Biotechnology, Faculty of Biotechnology and Food Sciences, Slovak University of Agriculture in Nitra, Tr. A. Hlinku 2, 949 76 Nitra, xhromadovaz@uniag.sk

#### Scientific Conference of PhD Students of FAFR, FBFS and FHLE SUA in Nitra – Proceedings of Abstracts SECTION **Biotechnology**

#### Assessing the Quality of Liptov Baldspotted Rabbit Sperm Utilizing the Novel Molecular Marker proAKAP4: A Comprehensive Analysis

#### Jakub VOZAF, Andrea SVORADOVÁ, Simona BALDOVSKÁ, Jaromír VAŠÍČEK, Andrej BALÁŽI, Miroslav BAUER, Lenka KUŽELOVÁ, Alexander V. MAKAREVICH, Peter CHRENEK

Supervisor: prof. Ing. Peter Chrenek, DrSc.

A-kinase anchor protein 4 precursor (proAKAP4) is a novel molecular marker used to determine sperm quality and fertility in mammals. Our research investigates the potential impact of low levels of proAKAP4 on elevated numbers of morphological abnormalities in rabbit spermatozoa. The research delves into the relationship between proAKAP4 expression, sperm motility, morphological integrity and fertility, employing flow cytometry assays to provide comprehensive insights. The experimental protocol involved sample collection, assessment of sperm movement characteristics and morphological abnormalities by computerassisted sperm analysis (CASA), proAKAP4 levels quantification (ELISA) and visualization (PCR), viability and apoptosis evaluation by flow cytometry (SYBR-14; SYTOX Green; YO-PRO-1). Fertilizing ability was tested by artificial insemination. Eight males of the Liptov Baldspotted Rabbit breed were used as an experimental group. After collection using an artificial vagina, sperm samples were divided into two qualitative groups according to motility parameters. Group A contained samples with total motility (TM) above 50% and progressive motility (PM) above 30%. Group B contained samples with TM and PM below these values. Significant differences (P < 0.05) between groups were noted in terms of TM ( $60.2\pm2.3$  vs. 22.6±4.2), PM (37.8±3.8 vs. 7.2±1.3) viability (39.3±5.3 vs. 6.1±0.7) and apoptosis (55±5.9 vs. 88.1 $\pm$ 4.1). In contrast, we did not observe significant differences (P > 0.05) regarding the levels of proAKAP4 (2.7±0.5 vs. 4.8±1.2), morphological abnormalities (35±4.1 vs. 38±4.6) and fertilization ability. According to proAKAP4 levels, both groups belong to the "poor semen quality" category (the kit manufacturer's classification) and the rate of morphological abnormalities exceeded the standard values for insemination doses, also in both groups. These results suggest that proAKAP4 levels in rabbit sperm indicate quality of spermatogenesis, or overall sperm quality rather than post-collection motility. This could be useful information for the selection of samples suitable for cryopreservation for the purposes of biodiversity protection, as samples intended for such preservation must be of the highest quality. We plan to conduct further analyzes to confirm this claim.

#### Keywords: rabbit, spermatozoa, local breeds, sperm quality, biodiversity

Acknowledgement: This research was funded by the Slovak Research and Development Agency (Grant: APVV-20-0006)

**Contact address:** Jakub Vozaf<sup>1</sup>; <u>xvozaf@uniag.sk</u>, Andrea Svoradová<sup>2,3</sup>; <u>andrea.svoradova@mendelu.cz</u>, Simona Baldovská<sup>1</sup>; <u>sbaldovska@gmail.com</u>, Jaromír Vašíček<sup>1,2</sup>; <u>jaromir.vasicek@uniag.sk</u>, Andrej Baláži<sup>2</sup>; <u>andrej.balazi@nppc.sk</u>, Miroslav Bauer<sup>2</sup>; <u>miroslav.bauer@nppc.sk</u>, Lenka Kuželová<sup>1</sup>; <u>kuzeloval@gmail.com</u>, Alexander Makarevich<sup>2</sup>; <u>alexander.makarevic@nppc.sk</u>, Peter Chrenek<sup>1,2</sup>; <u>peter.chrenek@uniag.sk</u>

<sup>3</sup> Department of Animal Morphology, Physiology and Genetics, Faculty of AgriSciences, Mendel University in Brno, Brno, Czech Republic

<sup>&</sup>lt;sup>1</sup> Slovak University of Agriculture in Nitra, Faculty of Biotechnology and Food Science, Institute of Biotechnology, Tr. A. Hlinku 2, 94901 Slovak Republic

<sup>&</sup>lt;sup>2</sup> NPPC, Research Institute for Animal Production Nitra, Hlohovecka 2, 95141 Lužianky-near-Nitra, Slovak Republic

### SECTION

### Animal Production

#### Maternal traits and viability of calves after birth of the charolais and aubrac breeds

Jaroslav DOBI, Klára VAVRIŠÍNOVÁ

Supervisor: doc. Ing. Klára Vavrišínová, CSc.

The beef cattle rearing is considered as the most natural way of breeding, the mother's care for the newborn calf as well as their viability are paramount to its start in life. In this study, maternal characteristics and calf viability after birth were evaluated of 150 Charolais (CH) and 122 Aubrac (AU) cows and of their offspring. Maternal traits and calf temperament after birth were evaluated by our own 5-point scale, where a score 1 to 5. Number 1 was given to animals without any problems. Number 5 was given to the most problematic cases. The analyzed results showed that 83.33% of CH cows and 92.62% of AU cows had excellent maternal traits and at the same time these cows did not show any signs of aggression towards man. The evaluation of maternal traits in cows of the CH breed shows a very low proportion of problematic cows (3.99%) in relation to the born calf (with scores 3 - absence of relation to the calf, 4 - negative relation to the calf and human immediately after birth, 5 - negative relation to the calf and human long after birth), while individual cases were registered more in first calving cows compared to older cows. Analysis of the dataset showed that the number of cows with a score of 2 (good calf care but showing aggression towards human) increased with cow age. When assessing maternal traits in AU, we observed a very low proportion of problem cows (0.82%) in relation to calf born, with individual cases (with grades 3 and 5), but unlike the CH set, problems were recorded more in older cows. In both evaluated sets, the relationship of impaired maternal traits to difficult calving was not confirmed. When assessing the temperament and viability of calves immediately after parturition (5-point scale from point 1, i.e. trouble-free and viable calves, to point 5 calves that do not even try to stand up and are without suckling reflex). From the results, we found that assistance to calves in suckling was necessary in cows that showed some form of behavioral disorders. Also, less viability of calves after birth was recorded after more difficult and prolonged calving. These results were found in both breeds studied.

#### Keywords: Charolais breed, Aubrac breed, maternal characteristics, viability, relationship

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**Contact address:** Jaroslav Dobi, Department of Animal Husbandry, Slovak University of Agriculture in Nitra, jaroslavdobi8@gmail.com

#### Udder health of goats on the farm

# Barbora GANCÁROVÁ, Kristína TVAROŽKOVÁ, Michal UHRINČAŤ, Martina VRŠKOVÁ, Vladimír TANČIN

#### Supervisor: prof. Ing. Vladimír Tančin, DrSc.

Goat milk production is a dynamic and growing industry but questions about the health status of goat udders are still a matter of debate. Our research aimed to assess the health status of the mammary gland based on the determination of somatic cell count (SCC) and identification of bacterial pathogens in goat milk. Milk samples (n=55) were divided into four SCC groups on the basis of SCC: SCC<sub>1</sub> <  $500 \times 10^3$  cells/ml; SCC<sub>2</sub>  $\ge 500 < 1000 \times 10^3$  cells/ml; SCC<sub>3</sub>  $\ge 1000$  $< 2000 \times 10^3$  cells/ml; SCC<sub>4</sub>  $\ge 2000 \times 10^3$  cells/ml. The lowest percentage (14.5%) of milk samples had SCC1, 25.5 % in SCC3, 29.1% in SCC4, and the highest percentage of samples were in SCC2 (30.9%). For bacteriological analysis the milk samples were cultured on blood agar plates and positive cultures were identified by MALDI TOF MS. In the majority of samples (80%) no pathogens were observed and bacterial presence was detected in 16.4% of milk samples. Only two of all half udder milk samples were considered as contaminated (3.6%) and one positive sample wasn't species-identified by MALDI TOF MS. Coagulase-negative staphylococci were predominantly bacterial isolated (88.9% of all positive samples). Staphyloccocus (S) caprae were isolated from 44.4% and it was the most prevalent environmental pathogen in goat milk. Other CNS were S. pasteuri, S. chromogenes, S. warneri, S. simulans, all with a prevalence of 11.1%. In conclusion, environmental pathogens are a normal part of the goat environment, but the risk of mastitis is higher in a poorly managed dairy goat herd.

#### Keywords: udder health, pathogens, somatic cells, goat milk, mastitis

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**Contact address:** Barbora, Gancárová, Institute of Animal Husbandry, Slovak University of Agriculture in Nitra Tr. A. Hlinku 2, 949 76 Nitra, Slovak Republic, xgancarova@uniag.sk

#### Genotype effect on estimated goat's cheese yield

#### Juraj GAŠPER, Martina MILUCHOVÁ, Michal GÁBOR

Supervisor: doc. Ing. Martina Miluchová, PhD.

Goat farming (Capra hircus) is aimed at the sale of goat cheese. Breeder's attention is focussing on Cost-to-Sales Ratio and factors which are affecting it. Cheese production depends not only on the amount of milk, but also on the hygienic and technological quality of milk processing. Hygienic quality is influenced by farmers through housing conditions, milking hygiene and milk storage, etc. On the other hand, technological quality depends more on milk caseins, especially  $\alpha_{S1}$ -case in, which is encoded by the CSN1S1 gene and which is directly influenced by the genetics of the animal. This case in is also associated with milk fat and protein content. The aim of this study was to estimate the yield of soft cheese for groups of CSN1S1 genotypes. In the study were genotyped 127 Slovak White Shorthair goats from two breeding farms in northern Slovakia were genotyped using PCR, AS-PCR and PCR-RFLP. Subsequently, the phenotypic data from the performance control carried out by the Breeding Service of the Slovak Republic were paired with the genotypes. For each goat, the yield of soft cheese per 100 L of milk was estimated based on the content of milk fat and protein. One-way ANOVA was used to determine whether the CSN1S1 polymorphism has a measurable effect on cheese yield. The genotypic structure of the observed population was as follows: AB (0.03), AE (0.09), AN (0.08), BE (0.17), BF (0.06), EE (0.17), EF (0.27), EN (0.02), FF (0.07), FN (0.02) and NN (0.02). Genotypes AB, FN, EN and NN were excluded from further estimation due to low incidence in the study population, and total of 108 heads were analysed. The mean and standard error of the estimated cheese yield for the genotypes AE, AN, BE, BF, EE, FE and FF were  $16.18 \pm 0.77$ ;  $15.25 \pm 0.78$ ;  $16.38 \pm 0.65$ ;  $15.97 \pm 0.95$ ;  $15.76 \pm 0.86$ ;  $15.56 \pm 1.06$  and 15.06 $\pm$  0.28 kg/100 L of milk respectively. A significant effect (P < 0.001) of CSN1S1 genotype on estimated cheese yield was found. A significant difference (P < 0.05) for estimated cheese yield was observed between means of genotypes BE > AN, BE > FE and BE > FF. The estimated gain was determined using GLM method for genotypes BE as  $+ 1.31 \pm 0.37$  kg/100 L of milk (P < 0.001), for AE as + 1.12 ± 0.41 kg/100 L of milk (P < 0.01) and for FB as + 0.90  $\pm$  0.47 kg/100 L of milk (P < 0.05). With the population milk yield mean of 854 L per goat per year and price of 15 €/ kg of fresh cheese we estimated economical gains for genotypes BE, AE and FB as  $+ 168 \notin$ ;  $+ 143 \notin$  and  $+ 116 \notin$  per goat per year respectively compared to genotype FF. Further researches are required for set real cheese yield for this population.

#### Keywords: goat, milk, CSN1S1, cheese yield

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**Contact address:** Ing. Juraj Gašper, Slovak University of Agriculture in Nitra, Faculty of Agrobiology and Food Resources, Institute of Nutrition and Genomics, Tr. A. Hlinku 2, 949 76 Nitra, Slovakia, xgasperj1@uniag.sk

#### Scientific Conference of PhD Students of FAFR, FBFS and FHLE SUA in Nitra – Proceedings of Abstracts SECTION Animal Production

#### Genomic inbreeding rates and effective population size of Slovak Holstein population

#### Adrián HALVONÍK, Nina MORAVČÍKOVÁ, Radovan KASARDA, Monika CHALUPKOVÁ

#### Supervisor: doc. Ing. Nina Moravčíková, PhD.

Inbreeding and effective population size  $(N_e)$  are fundamental parameters used in the management and conservation of livestock populations. Recent development in genome-wide genotyping technologies has enabled us to estimate these parameters based on genomic data. The aim of this study was to analyse  $N_e$  using a method based on linkage disequilibrium and inbreeding coefficient (F) by scanning uninterrupted homozygous segments in the genome called runs of homozygosity (ROH). The genomic data of 134 cows from three different farms in Slovakia was analysed. After quality control, the dataset included 132 animals and 45012 autosomal informative Single Nucleotide Polymorphisms (SNPs). The  $N_e$  over the past 60 generations and estimated the current  $N_e$  through regression analysis from 60 to 10 generations ago were calculated with software SNeP. The calculation shows that the current  $N_e$  is 38. After the comparison of current  $N_e$  with  $N_e$  in past generations, a significant decrease in number of animals (average decrease of 2.38 animals per generation) was found. This probably occurs due to the use of limited number of animals in the mating plans. Estimates of current inbreeding  $(F_{ROH>16MB}$  and  $F_{ROH>8MB}$ , representing inbreeding accumulated 3 and 6 generations ago, respectively) show negligible differences after the comparison of the results of different methods. F<sub>ROH</sub> obtained by two different approaches utilizing Hidden Markov model (HMM) for detecting ROH, were 2.9% and 3% for  $F_{ROH>16MB}$  and 6% and 6.3% for  $F_{ROH>8MB}$ , respectively.  $F_{ROH}$  obtained by consecutive-runs method was 2.8% for  $F_{ROH>16MB}$  and 5.6% for  $F_{ROH>8MB}$ . However, the results of historical inbreeding showed greater variability depending on the method used.  $F_{ROH}$  obtained by HMM was 11.3% and 11.1% for  $F_{ROH>1MB}$  and 10.6% and 10.8% for  $F_{ROH>2MB}$ , while results obtained by the consecutive-runs method were 16.5% for  $F_{ROH>1MB}$  and 12.9% for  $F_{ROH>2MB}$ .  $F_{ROH}$  estimates indicated that analysed Holstein population shows relatively high levels of historical as well as current inbreeding. Based on the obtained trends of  $F_{ROH}$  and  $N_e$ , it can be concluded that the genetic variability of this population is decreasing over generations. In addition, results of  $F_{ROH}$  clearly illustrate the differences between used methods, especially when it comes to segments with a small number of SNPs. This can be helpful when sparse information is used or short segments are attempted to detect. The observed disparities between methods underscore the importance of method selection in population genetics analysis.

#### Keywords: Effective population size, Hidden Markov model, Holstein cattle, Inbreeding

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**Contact address:** Ing. Adrián Halvoník, Slovak University of Agriculture, Faculty of Agrobiology and Food Resources, Institute of Nutrition and Genomics, Tr. A. Hlinku 2, 94976 Nitra, email: <u>xhalvonik@uniag.sk</u>

#### The impact of ecological factors on population density of wild boar in Slovakia

#### Martina HUSTINOVÁ, Nina MORAVČÍKOVÁ, Radovan KASARDA

Supervisor: prof. Ing. Radovan Kasarda, PhD.

The impact of global warming is bringing many changes in ecosystems, and currently, discussions about changes in average global temperatures provide us with very little information in the context of Slovakia. The aim of the study was to examine the influence of selected ecological factors - average temperature, average monthly precipitation, snowfall, and soil temperature in 5 self-governing regions of Slovakia that were not affected by the occurrence of African swine fever (ASF). Data on spring population figures by region from the Hunting Statistical Yearbook processed by the National Forestry Center, and ecological characteristics from bulletins of monthly meteorological data from the Slovak Hydrometeorological Institute were drawn. For the estimation of interactions between ecological factors and wild boar population density, regression analysis was used Microsoft Excel. In general, a positive influence of the average annual temperature on the development of spring population figures was found. The analysis of data from the five self-governing regions revealed a relatively high variability in the determination coefficient, ranging from 1.79% (Trnava region) to 91.86% (Zilina region). The low determination coefficient in the Trnava region is most likely due to the fact that users of small game hunting grounds do not report any spring population figures of wild boar. The other regions (Trencin, Zilina, Bratislava) showed determination coefficients ranging from 66.89% to 91.86%, with the exception of the Banska Bystrica region. This region was already affected by the occurrence of ASF virus in the observed period of 2021 and 2022, which also caused a significant decrease in spring population figures counts in those years. In the observed 3-year period without ASF, the coefficient ranged around 79.41%. Interaction between population density of wild boar in context of ecological factors could be explained in context of climate change. However, ASF significantly affects population density. Further analysis will be concerned on detailed view from regional perspective.

**Keywords:** wild boar, ecological factors, temperature, density, African swine fever, hunting, hunting management,

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**Contact address:** Ing. Martina Hustinová, Slovak University of Agriculture in Nitra, Faculty of Agrobiology and Food Resources, Institute of Nutrition and Genomics, Trieda Andreja Hlinku 2, 949 76 Nitra-Chrenová, e-mail: priroda@polovnictvo.sk; Slovak Hunting Chamber, Štefánikova 10, 811 05, Bratislava, Slovakia

#### Scientific Conference of PhD Students of FAFR, FBFS and FHLE SUA in Nitra – Proceedings of Abstracts SECTION Animal Production

#### Genetic evaluation of health traits by different approaches

#### Monika CHALUPKOVÁ, Radovan KASARDA, Nina MORAVČÍKOVÁ, Juraj CANDRÁK, Adrián HALVONÍK

#### Supervisor: prof. Ing. Radovan Kasarda, PhD.

Claw diseases are one of the most common farm problems. Its prevalence is largely influenced by the breeding environment. It is estimated that up to 75% of dairy cows in Europe suffer from claw disease, with 70% of cows being in the UK and between 40% and 80% in the Netherlands. Typically, claw disorders (digital dermatitis, interdigital dermatitis, heel horn erosion, interdigital hyperplasia, sole ulcer, white line disease) are defined as binary and analysed by linear models, which are often used for routine genetic evaluation due to their speed and ease of implementation. The aim of the study was to evaluate the basic genetic parameters of claw diseases by different approaches. A total of 10928 cows from 6 intensive dairy farms were evaluated in the western part of Slovakia, whose phenotypic records were collected from 2017 to 2022. These farms are currently ranked among the top 50 of Holstein farms in Slovakia for milk production. Two databases for the estimation of heritability were used. In the first database, cows were divided into three groups: 0 (healthy, 9594 cows), 1 (cows with infectious claw disease, 887 cows), and 2 (cows with non-infectious claw disease, 447 cows). In the second database, binary coding for the diseases was used: 0 (healthy, 9594 cows) and 1 (cows with claw disease, 1334 cows). Information about 3 generations of ancestors and 23876 individuals were included in the pedigree database. Heritability was estimated using a singletrait animal model in the programs REMLF90 and CBLUP90REML. In the model, fixed effects included the herd (6) and breed (2), as well as a random additive effect of the animal (10,829). Higher heritability (0.17) was observed for cows with binary coding compared to cows divided into three classes (0.09). For cows with infectious claw diseases the heritability was estimated to be 0.14. It was unable to estimate  $h^2$  for non-infectious claw diseases. Health is an important factor which reflects welfare and influences the economic sustainability of farms. It was confirmed that claw traits are heritable, which allows them to be used in selection indices. Further research will be oriented of other health traits (udder health, mastitis, metabolic disorders) to allow complex view on genetic determination of dairy cows health.

#### Keywords: Holstein breed, heritability, claw diseases

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**Contact address:** Monika Chalupková, Institute of Nutrition and Genomics, Slovak University of Agriculture in Nitra Tr. A. Hlinku 2, 94976 Nitra, Slovakia, <u>xchalupkovam@uniag.sk</u>

# Effect of selected feed additives on growth performance and the intestinal microbiota of the Common carp (*Cyprinus carpio*)

Elshafia ALI HAMID MOHAMMED, Milán FEHÉR, Péter BÁRSONY, Abdelhakam Esmaeil Mohamed AHMED, Ayaz Mukarram SHAIKH, Károly PÁL

#### Supervisor: Dr. Károly Pál. PhD

The research aimed to examine the impact of various feed additives on the growth performance and intestinal microbiota of the common carp (Cyprinus carpio). Three different feed additives including Bactocell (live lactic acid bacterium Pediococcus acidilactici CNCM I-4622 MA 18/5M), Levucell (probiotic derived from the fungus Saccharomyces cerevisiae boulardii CNCM I-1079) and YANG prebiotic (Saccharomyces cerevisiae AQP1260, S. cerevisiae AQP 12988 and Cyberlindnera jandinii AQP 12549) were tested at the concentration of 1% (10 g/1 kg of basic diets) in addition to the control (basic feed only). Fish with average body weight (g) of 932±163 were fed with supplemented diet for 45 days in a recirculation system (RAS). The RAS contains 12 units (size=1000 liter each unit, 8 fish per unit). Water temperature, pH, total dissolved solids, dissolved oxygen, NO<sup>-2</sup>, NO<sup>-3</sup>, and NH<sup>+4</sup> concentrations were maintained within optimal levels. After the end of the feeding experiment, fish feces samples were collected and the bacterial community structure found in the intestines of common carp was analyzed through a metagenomic approach using 16S rDNA sequencing. The results indicated that there was no significant effect (P<0.05) of the tested feed additives (Bactocell, Levucell and YANG) on growth performance (final body weight), feed conversion ratio (FCR) and specific growth rate (SGR). The results of the metagenomic data of carp fed with a diet supplemented with YANG showed 11 different groups of bacterial phyla detected with the top three phyla, namely Fusobacteria (55%), Firmicutes (36%), and Proteobacteria (6%). In contrast, fecal samples from carp fed with 1% Bactocell recorded 10 phyla. The top three phyla were Proteobacteria (70%), Fusobacteria (21%), and Firmicutes (5%). A sample of carp fed with Levucell recorded 9 phyla, the top three phyla were Fusobacteria (50%), Proteobacteria (35%), and Firmicutes (14%). Finally, samples from carp fed with the basal diet (the control) recorded 14 phyla. The top three phyla recorded were Fusobacteriota (68%), Proteobacteria (27%), and Bacteroidota (3%). The study found that the tested feed additives did not significantly affect the growth performance of common carp. However, they did lead to variations in the composition of the intestinal microbiota of the common carp.

Keywords: Bactocell, Levucell, YANG, Common carp, 16S rRNA gene.

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**Contact address**: Elshafia Ali Hamid Mohammed, University of Debrecen, Faculty of Agric., Food and Science and Environmental Management, Dept. of Animal Science, Debrecen, Böszörményi 138, Hungary, Agriculture Research Corporation (ARC), Edamer, Sudan, <u>elshafia@agr.unideb.hu</u>. Károly Pál: University of Debrecen, Faculty of Agric., Food and Science and Environmental Management, Dept. of Food Science, Debrecen, Böszörményi 138, Hungary <u>pal.karoly@agr.unideb.hu</u>. Milán Fehér: Department of Animal Science – Laboratory of Aquaculture, Faculty of Agricultural and Food Sciences and Environmental Management <u>feherm@agr.unideb.hu</u>. Péter Bársony: University of Debrecen, Faculty of Agricultural and Food Sciences and Environmental Management Institute of Animal Science, Biotechnology and Nature Department of Nutrition Physiology <u>barsonp@agr.unideb.hu</u>.

#### Comparison of egg weight in individual breeding systems

#### Ján PETROVIČ, Martin MELLEN

Supervisor: doc. PhDr. Ing. Martin Mellen, PhD.

The aim of the experiment was to compare and evaluate the weight of eggs from individual breeding systems. The research was carried out on a poultry farm in parallel in a cage system, on deep litter and in aviaries and measurements in laboratory conditions with Bovans Brown layers aged 32 to 47 weeks. The results were statistically analyzed with the SAS system program, version 8.2. In all three systems of laying hens, sampling of randomly selected eggs from daily laying was carried out, n = 30 at the age of hens of 32 weeks (1st attempt, following sampling on the farm in the month of August, age of hens 34 to 38 weeks), n = 30 in hens aged 40 weeks (2nd trial, following sampling on the farm in September, hens aged 39 to 43 weeks) and n = 30 hens aged 47 weeks (3rd trial, following sampling on the farm in October, hens aged 43 to 47 weeks). The weight of the egg was determined by weighing the egg (1-n) on a laboratory balance, type KERN PCB, with an accuracy of  $d \pm 0.001$  g. The variances of egg weight in the three different rearing systems were statistically very significantly different (109.77<sup>+++</sup>,  $P \le 0.001$ ), which was confirmed by the F-test result, which verified the assumption of equality of variances. The null hypothesis H0 of no difference between the laving systems was rejected. The average egg weight was 60.88 g in the cage rearing system, 63.22 g in the deep litter rearing system and 57.44 g in the aviaries. The difference in egg weight was statistically significant (P  $\leq$  0.05) by comparing the monitored different laying systems. A statistical evaluation of the weight of eggs expressed by the standard deviation and the coefficient of variation revealed a fluctuation in the values from the largest in order in aviaries, on deep bedding and in cages (SD = 2.24; 0.39 and 0.20, CV = 3.90; 0.62 and 0.33%).

#### Keywords: egg, breeding system, egg weight, laying hens

**Contact address:** Ján Petrovič, Slovak University of Agriculture in Nitra, Faculty of Agrobiology and Food Resources, Institute of Animal Husbandry, Tr. A. Hlinku 2, 949 76 Nitra, jan.petrovic83@gmail.com

#### Effect of breed and parity on reproductive performance of pigs

#### Daniel RAJČOK, Ivan IMRICH

Supervisor: doc. Ing. Ivan Imrich, PhD.

The reproductive performance of sows plays a critical role in the economics of pig production. The most important parameters of reproductive performance are total born piglets, preweaning mortality and the number of parity per year or farrowing interval. The aim of this study was to compare the effect of breed and parity on reproductive performance of pigs. In the experiment, sows of the Large White (Lw) breed and the Large White x Landrace (Lw x La) hybrid combination were evaluated in parity 1 to 5. A total of 77 parity were evaluated (Lw - 25, Lw x La 52). All pigs were housed in the same conditions. The farrowing pens were 5 x 3.5 m with space for warming the piglets. The floor in the housing was concrete, thatched with straw. The sows were fed a commercial feed mixture for pregnant sows. We monitored the number of total born piglets, the number weaned and the length of the farrowing interval. The results showed that the length of the farrowing interval in the Lw breed was  $159.7 \pm 15.9$  days. In Lw x La hybrid combination it was  $168.1 \pm 28.4$  days, but the difference was not statistically significant (p>0.05). The number of total born piglets was  $13.4 \pm 2.6$  for the Lw breed and  $13.0 \pm 2.5$  for the Lw x La hybrid combination (p>0.05). The longest farrowing interval was between the 4th and 5th parity (184.8  $\pm$  49.6 days). The farrowing interval on the 2nd to 4th parity ranged from  $162.0 \pm 14.6$  days to  $164.63 \pm 19.9$  days. However, the differences in the length of the farrowing interval were not significant (p>0.05). The number of total born piglets increased from parity 1  $(11.3 \pm 2.4)$  to parity 3  $(14.1 \pm 2.2)$  and then began to decrease. The number of total born piglets in parity 2 to 4 was significantly higher than in parity 1 (p < 0.05). The number of weaned piglets increased from parity 1 (10.0  $\pm$  1.6) to parity 4 (11.3  $\pm$  1.6), but the differences were not statistically significant (p>0.05). These results indicate that the Lw breed and the Lw x La hybrid combination had similar reproductive performance, which increased significantly until the 4th parity. After the 4th parity there was a decrease in reproductive performance in sows.

#### Keywords: pigs, reproduction, breed, parity

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**Contact address**: Daniel Rajčok, Institute of animal husbandry, Faculty of agrobiology and food resources, Slovak university of agriculture in nitra, Tr. A. Hlinku 2, 949 76 Nitra, e-mail: <u>xrajcok@uniag.sk</u>.

#### The effect of natural additives in nutrition on the regeneration of horses

# Monika ŠMONDRKOVÁ, Marko HALO, Eva MLYNEKOVÁ, Branislav GÁLIK, Marko HALO Jr.

#### Supervisor: prof. Ing. Marko Halo, PhD.

The sports use of horses is a common part of overall breeding management. The high performance of horses demands a toll in the form of high demands on breeding management. With this fact comes the idea of accelerating the horse's recovery after exertion and influencing its nutrition to enable it to make the best use of all its components. In our work, we focused on adding 90g of pollen to the horses' feed and observed its impact on their health. Additionally, we monitored feeding duration and overall consumption. The experiment lasted for three months and involved 12 horses divided into two groups. Both groups were stabled in individual boxes on a mixture of sawdust and straw. The boxes were equipped with feeding troughs, automatic waterers, and mineral licks. Both groups underwent standard training with the same workload. They were fed with a volume-based diet of meadow hay in the amount of 10kg, concentrated feed in the form of a complete feed mixture at 4kg, and in the experimental group, 90g of pollen was added. The horses were stabled at the Experimental Center of Farm Animals at the Institute of Animal Breeding, SPU FAPZ in Nitra. Samples were obtained by jugular vein puncture, and the samples collected by a veterinarian were processed and analyzed for the data: alanine aminotransferase (ALT), glucose, and aspartate aminotransferase (AST). Pollen is considered a nutritionally complete component that contains all the essential and important nutrients. Its effect on the health of horses has been studied by several trainers who have noted its positive impact on nutrient retention and digestibility in the horse's body. By incorporating pollen into the feed of sport horses, they were able to provide the body with all the essential nutrients during increased load, without increased excretion. This allowed the body to successfully draw the necessary components during physical stress better than the body with lower nutrient digestibility. In the analysis of AST, we observed a faster decrease in the tested horses compared to the horses in the control group. The values in both groups remained above reference values, which decreased during the testing period to the upper limit of the reference optimum. ALT values remained within the range of physiological optimum throughout the research. Glucose levels were higher on average by 0.46 mmol.1<sup>-1</sup> in the first, experimental group compared to the second group. While no statistically significant differences were found in the results between the two groups, we observed more balanced levels of the individual monitored parameters in the experimental group to which pollen was added to the feed.

#### Keywords: healthy, horse, pollen, performance

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Contact address: Monika Šmondrková, FAPZ, SPU Nitra, xsmondrkovam@uniag.sk

### SECTION

Applied and molecular biology

# The effect of endocrine disruptors on the activation of microinflammatory processes of blood vessels

Denis BAŽÁNY, Hana GREIFOVÁ, Nikola ŠTEFUNKOVÁ, Norbert LUKÁČ

Supervisor: prof. Ing. Norbert Lukáč, PhD.

One of the most significant medical findings of recent decades has been that the immune system and inflammatory processes are involved in a wide variety of mental and physical health problems that dominate global mortality and morbidity. The inflammatory response is a defense mechanism that has evolved in higher organisms in response to harmful stimuli caused by microbial infection, tissue damage, and other harmful environmental influences.

The presented work primarily focuses on how inflammation can be altered by a large group of chemicals that disrupt the endocrine system - bisphenols. Endocrine-disrupting chemicals (EDCs) are ubiquitous substances that can be easily found in the human environment, food, and various consumer products. Bisphenols are chemical compounds with one of the highest global production volumes. The aim of our *in vitro* study was to evaluate the potential influence of selected bisphenols on the activation and alteration of the inflammatory process pathway. In the experimental part, we used the HUVEC cell line, derived from the endothelium of the umbilical vein. We analyzed essential parameters such as viability, mitochondrial activity, metabolic activity, lysosomal integrity, and intracellular superoxide radical production. Subsequently, using the ELISA method, we quantified markers of the inflammatory process, interleukin-6, interleukin-8, prostaglandin E2 as well as vascular endothelial growth factor. HUVEC endothelial cells were cultured for 24 h with selected concentrations of bisphenol S and bisphenol A (0.05; 0.1; 1; 10; 25; 50  $\mu$ M). Despite the unaffected viability of endothelial cells at the selected concentrations of BPS, we noted significant differences in the production of some inflammatory markers. Even though cell viability was unaffected, we detected a significantly increased production of IL-6 in cultivation medium. At concentration of 1 µM, the level of significance was P<0.001, at 10 µM (P<0.01) and at 25 µM (P<0.05). Evaluation of IL-8 production from cell lysates shown significantly decreased production of this cytokine at concentrations of 0.05; 0,1 and 1 µM. At all three concentrations the levels of significant decrease represented P<0.001. Last but not least part of methodology was to assess the production of one of ending products of cyclooxygenase pathway - prostaglandin E2. Our results have shown that at concentration of 1  $\mu$ M BPS treatment, the increase of PGE2 production was at level of significance (P<0.05), at 10 µM (P<0.01) and at 25 µM (P<0.05). Bisphenol S poses a significant concern as an immunotoxicant capable of altering the inflammatory process in biological systems.

#### Keywords: HUVEC, bisphenol S, bisphenol A, inflammation, endocrine disrupting chemicals

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**Contact address:** Ing. Denis Bažány, Institute of Applied Biology, Faculty of Biotechnology and Food Sciences, Slovak University of Agriculture in Nitra, Tr. A. Hlinku 2, 949 76 Nitra, Slovak Republic, xbazany@uniag.sk

# Scientific Conference of PhD Students of FAFR, FBFS and FHLE SUA in Nitra – Proceedings of Abstracts SECTION Applied and molecular biology

#### In Vitro effect of platinum nanoparticles on motility and viability of rabbit spermatozoa

Lucia DIANOVÁ, Filip TIRPÁK, Marko HALO Jr., Tomáš SLANINA, Michal LENICKÝ, Nikola ŠTEFUNKOVÁ, Ľubomír ONDRUŠKA, Peter MASSÁNYI

Supervisor: prof. MVDr. Peter Massányi, DrSc.

Various studies have shown that sperm cells are highly sensitive to toxic elements found in the environment. Thanks to technological progress, the use of nanoparticles is becoming more and more common nowadays. Nanoparticles are used for drug delivery because their size allows them to circulate in the body and enter directly into the cell. Antimicrobial properties are increasingly used in the production of medical devices, textiles, food packaging, cosmetics, and other consumer products. Nanoparticles provide multiple advantages, but aspects related to their effects on living organisms and the environment are not well understood. The aim of this study was to investigate the influence of platinum nanoparticles on the quality of rabbit spermatozoa in vitro. Rabbit semen (n=6) was cultured with solutions with different concentrations of platinum nanoparticles (control = 0.9% NaCl; D =  $62.5 \mu \text{g.ml}^{-1}$ ; E = 31.25 $\mu$ g.ml<sup>-1</sup>; F = 15.63  $\mu$ g.ml<sup>-1</sup>; G = 7.81  $\mu$ g.ml<sup>-1</sup>; H = 3.91  $\mu$ g.ml<sup>-1</sup>, I = 1.95  $\mu$ g.ml<sup>-1</sup>; J = 0.98  $\mu$ g.ml<sup>-1</sup> <sup>1</sup>;  $K = 0.49 \mu g.ml^{-1}$ ;  $L = 0.24 \mu g.ml^{-1}$ ) in time intervals of 0, 2, 4 and 6 hours, during which the effect of nanoparticles on spermatozoa motility was evaluated. Selected parameters were analysed – total motility (MOT; %), progressive motility (PRO; %), curvilinear velocity (VCL; μm.s<sup>-1</sup>), amplitude of lateral head displacement (ALH; μm) and beat cross frequency (BCF; Hz). We found that platinum nanoparticles had a demonstrably adverse effect on all evaluated parameters of spermatozoa motility, while the most significant results were achieved in a time interval of 4 hours, especially in the case of the highest concentrations of added nanoparticles  $7.81 - 62.5 \mu \text{g.ml}^{-1}$ . After 6 hours of cultivation, analyses aimed at evaluating cell viability (MTT, AlamarBlue test) and superoxide radical production (NBT test) were also performed. No significant results were achieved in any of these analyses, however, in the case of the NBT test, there was a decreasing trend in concentrations D - H and a subsequent increase in the production of superoxide radicals in samples I - L. It was shown that the effect of platinum nanoparticles is time and dose dependent. However, further analyses are needed to take complete conclusions.

#### Keywords: platinum nanoparticles, Pt, sperm, rabbit, CASA, MTT, NBT

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**Contact address:** Lucia Dianová - Institute of Applied Biology, Faculty of Biotechnology and Food Sciences, Slovak University of Agriculture in Nitra, Tr. Andreja Hlinku 2, 949 76 Nitra, Slovakia, <u>xdianova@uniag.sk</u>

#### Effect of ZnO nanoparticles on bull spermatozoa motility and viability

#### Michal LENICKÝ, Lucia DIANOVÁ, Marko HALO Jr., Peter IVANIČ, Nikola ŠTEFUNKOVÁ, Tomáš SLANINA, Peter MASSÁNYI

Supervisor: prof. MVDr. Peter Massányi, DrSc.

Technological progress and the widespread application of nanoparticles brings with it the question of their biological safety. Environmental pollution with nanoparticles may contribute to health problems associated with reduced fertility. However, there are also findings that discuss the beneficial effects of ZnO nanoparticles. Therefore, this study aimed to focus the effect of zinc oxide (ZnO) nanoparticles on bull spermatozoa in a wide range of concentrations and to assess the effect on spermatozoa motility characteristics. As a cell model, the spermatozoa (semen) from sexually mature bulls of the Holstein breed (n=7) (Slovak Biological services, a.s., Nitra) was used. Semen (spermatozoa) were diluted in solutions with different concentrations (A  $- 2000 \,\mu\text{g/ml}$ , B  $- 100 \,\mu\text{g/ml}$ , C  $- 500 \,\mu\text{g/ml}$ , D  $- 250 \,\mu\text{g/ml}$ , E  $- 125 \,\mu\text{g/ml}$ ,  $F - 62.5 \ \mu g/ml$ ,  $G - 31.25 \ \mu g/ml$ ,  $H - 15.62 \ \mu g/ml$ ,  $I - 7.81 \ \mu g/ml$ ,  $J - 3.90 \ \mu g/ml$ ,  $K - 1.95 \ \mu g/ml$  $\mu g/ml$ , L = 0.975  $\mu g/ml$ , M = 0.487  $\mu g/ml$ , N = 0.243  $\mu g/ml$ , O = 0.121  $\mu g/ml$ , P = 0.060  $\mu g/ml$ ) of ZnO nanoparticles in a ratio of 1:50. As a control the physiological solution was used. The experimental groups were incubated for 5 hours in an incubator at a temperature of 37°C. To determine the motility characteristics (MOT, PRO, VCL, BCF, ALH) of spermatozoa, a computer-assisted sperm analysis (CASA system) was used, and the analysis was realized after 0, 1, 3 and 5 hours of culture. Evaluation of cell metabolic activity was carried out using the colorimetric MTT test, overall viability was evaluated using the Alamar Blue test. Also, the superoxide production of spermatozoa was analyzed using the NBT test. The highest concentrations (A – 2000  $\mu$ g/ml, B – 1000  $\mu$ g/ml, C – 500  $\mu$ g/ml) had a cytotoxic effect, as a significant decrease in spermatozoa motility characteristics (MOT, PRO) after 3 and 5 hours of incubation were noted. Our results recorded better but insignificant values in the middle concentration range (from 125 µg/ml to 0.975 µg/ml). Higher concentrations were primarily prooxidative. The lowest ROS production was at concentrations of 31.25 µg/ml, 15.62 µg/ml and 7.81 µg/ml. On the other hand, an increase in viability and metabolic activity was observed after 1 and 3 hours of incubation at a concentration of 2000 µg/ml and 62.5 µg/ml. In conclusion, we can state that our results of the effect of ZnO nanoparticles on the motility characteristics and viability of spermatozoa are strongly related to the time of exposure and dose.

#### Keywords: nanoparticles, ZnO, spermatozoa, motility, viability

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**Contact address:** Michal, Lenický, Institute of Applied Biology, Faculty of Biotechnology and Food Sciences, Slovak University of Agriculture in Nitra, Tr. A. Hlinku 2, 949 76 Nitra, Slovak Republic, xlenicky@uniag.sk

#### Diversity of *Streptomyces* spp. from the extreme environment of metallurgical waste slag in Istebné, Slovakia

#### Ivana TIMORACKÁ

Supervisor: doc. Ing. Simona Kunová, PhD.

Environments with harsh and extreme conditions are known to be a wide source of interesting microorganisms. Bacteria from the genus Streptomyces are a relatively common group of bacteria even in extreme environments. This group of bacteria is especially well known for their production of bioactive secondary metabolites and useful enzymes. Thanks to those features they find a wide application in various fields of the biotechnology industry. Some extreme environments are characterized by high concentrations of heavy metals. Heavy metals often enter the environment as a result of anthropogenic activities associated with metallurgy. Nowadays, more and more attention is being paid to the discovery and study of microorganisms that can exist in heavy-metal contaminated environments. It's assumed that new foundings will be used to bioremediate contaminated environments or that we will find new species producing biotechnologically useful secondary metabolites or enzymes. In this work, we characterized 36 selected cultivated isolates with a morphology typical of *Streptomyces*, isolated from the waste slag from a metallurgical industry in Istebné, Slovakia. The genetic diversity of isolates was firstly compared based on RFLP analysis of the 16S rRNA (AluI, HaeIII) and gyrB (AluI, RsaI) genes. Genetic characterization of the selected group of five isolates was based on the 16S rRNA and gyrB sequences and BLASTN analysis. All genetically characterized isolates belonged to the genus Streptomyces. The isolates could not be unambiguously assigned to species because the sequences of both genes showed similarity to several Streptomyces species in the database. Enzymatic activity (lipo-, cellulo-, amylo-, and proteolytic), antimicrobial potential and tolerance to selected heavy metals (Cr<sup>6+</sup>, Cu<sup>2+</sup>, Mn<sup>2+</sup>, Ni<sup>2+</sup>, Fe<sup>2+</sup>, Zn<sup>2+</sup>) of 36 tested isolates were also examined. Evidence of enzyme activity was observed in every isolate. Isolates showed antimicrobial activity against Bacillus cereus (11% of tested isolates) and Staphylococcus sp. (35% of tested isolates) using the soft agar overlay technique. Each metal was tolerated at concentrations higher than 250 mg.L<sup>-1</sup>. Overall isolates showed the highest tolerance to  $Cr^{6+}$ . In general, isolated *Streptomyces* bacteria have a relatively remarkable enzymatic potential and tolerance to heavy metals. Their bioremediation potential depends, besides others, on the above-mentioned properties. The potential antibacterial activity of isolates could be enhanced by induction with heavy metals at subinhibitory concentrations.

Keywords: heavy metals, Streptomyces, genetic diversity, enzymatic activity

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**Contact address:** Ivana Timoracká, Institute of Food Sciences, Faculty of Biotechnology and Food Sciences, Slovak Agriculture University in Nitra, Tr. A. Hlinku 2, 949-76 Nitra, Slovakia, e-mail: xtimoracka@uniag.sk

### SECTION

### Nutrition

# Health risk assessment of consumption of cow's milk and cheese from a conventional farm in Slovakia

# Simona ALMÁŠIOVÁ, Róbert TOMAN, Martina PŠENKOVÁ, Vladimír TANČIN, Ivona JANČO

Supervisor: prof. Ing. Róbert Toman, Dr.

Cow milk and cheese are in Slovakia consumed regularly and frequently and they represents important part in human nutrition. Nowadays they are easily accesible and they provide various benefits to consumers. Cheese is basicly concentrated form of milk, which means that it is nutrient-dense and energy-dense ingredient. Consumption of milk and dairy products contributes to the growth and development of children, to the formation and maintenance of strong bones and teeth, but also shows positive effects on blood pressure and prevents other diseases as obesity, diabetes mellitus, hypertension, and osteoporosis. The aim of the research work was to determine the content of essential and toxic elements in samples of cow milk and two types of cheese made from the tested milk and consequently count health risk assessment for the consumption of monitored products. The content of 22 elements (Ag, Al, As, Ba, Ca, Cd, Co, Cr, Cu, Fe, K, Li, Mg, Mn, Mo, Na, Ni, Pb, Sb, Se, Sr, Zn) was measured in 36 samples of tank cow milk and two types of cheese – soft cheese and traditional semi- hard cheese called "Oštiepok" which were collected from conventional farm in region Zvolensko- Podpol'anie and according to division made by Slovak environmental agency and Ministry of Environment of the Slovak Republic region represents potential undisturbed area. Analysis of the elements were determined using an inductively coupled plasma-optical emission spectrometer with axial plasma configuration and with auto-sampler SPS-3. For health risk assessment we used an average consumption data per consumer from Statistical office of Slovak republic (0.12 kg for milk, 0.01 kg for soft cheese and 0.02 kg for hard cheese). But calculations were made for higher consumed amounts as well (0.3 kg and 0.5 kg for milk and 0.1 kg and 0.2 kg for cheeses). Estimated daily intake as a pre- step in health risk assessment for toxic elements was calculated with average body weight (70 kg) and then compared with PTDI/ PTWI (potentional tolerable daily/ weekly intake). Concentrations of individual estimated intakes of essential elements found in milk were compared with recommended doses for Slovak population for 10 population group: children in preschool age, girls and boys in teenage years for each sex separately, 3 age group for men and women for each sex (19 - 34 years, 35 - 62 years, 65 - 79 years) and pregnant women. Our results are in agreement that calcium, potassium, sodium and magnesium are the elements found in the highest concentrations in milk in general. The highest amount of Ca (5774.18 mg/kg) and Na (6468.22 mg/kg) have been found in Oštiepok cheese, K (979.42 mg/kg) in milk and Mg (202.79 mg/kg) in soft cheese. Calculations provided evidence that milk and cheeses are significant source of Ca, Mg and K and contributes to recommended daily intakes for various age groups. Consumption of 0.31 of milk fulfil 44% of Ca and 45% Se of daily recommended intake for preschool children. Consumption of 0.5 l of milk fulfil 37-47% of Ca, 12-16% of Mg and 271 – 317% of Se recommended daily dose for adults. And since cheese is concentrated and more dense food, consumption of 100 g of cheese provides 81 % Ca, 49% Zn, 17 % Mg of recommended doses for childrens, 43 – 47% Ca, 22 – 26% Se, 20 - 27% Zn for teenagers and 40 - 52% Ca, 17 - 34% Zn, 117 - 137% Se for adults. Elements Ag, Cd, Co, Cr, Mo were found in all samples below the detection limit. We detected barium, strontium, antimony, lithium and nickel in trace amounts which are considered to be safe for human health. According to health risk assessment, consumption of average amount of milk and cheese contributes 1 - 2% PTDI/ PTWI of those elements in trace amounts. Naturally, with higher intake percentage is higher, but still low and safe (2 - 9%). Content of lead in cheeses

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could be problematic, since maximum permissible limit in milk and dairy products set by the European Commission is 0.020 mg/L. In the presented work, we determined lead in samples of soft cheese in average concentration 0.05 mg/kg and in Oštiepok the average concentration was 0.06 mg/kg. According to serious health adverse effects caused by lead, there is no possible to set PTDI or PTWI currently and the limit set in past has been withdrawn. In this regard, we suggest regular and long- term monitoring of situation.

Keywords: cow milk, cow cheese, essential elements, toxic elements, health risk assessment,

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**Contact address:** Simona Almášiová, Institute of Animal Husbandry, Faculty of Agrobiology and Food resources, Slovak University of Agriculture in Nitra, Trieda Andreja Hlinku 2, 949 76 Nitra, xalmasiova@uniag.sk

#### Changes in fatty acid content of broilers after feeding an alternative protein source -Black soldier fly (*Hermetia illucens*) larvae meal

Stanislava DROTÁROVÁ

Supervisor: prof. Ing. Branislav Gálik, PhD.

Different quality and level of nutrition can affect the concentration and fatty acid profile of broilers. Our aim was to investigate to what extent feeding an alternative protein source, insect meal from Black soldier fly (Hermetia illucens) larvae, can not only affect growth parameters of broilers, but also alter the fatty acid content of subcutaneous fat. During the experiment, the experimental animals were fed experimental diets with different levels of partially defatted insect meal replacing soybean meal extract at 50% and 100%. A total of 131 Cobb 50 hybrid one day old broilers were included in the experiment and divided into three experimental groups (control group, group with 50 % soybean extracted meal replacement and group with 100 % soybean extracted meal replacement). The experiment was conducted for 37 days, during which 2 fattening stages were carried out. At the end of the experiment, 30 experimental animals were selected and analysed for fatty acid content in the subcutaneous fat from the breast muscle. At the same time, the fatty acid content profile of Black soldier fly (Hermetia illucens) larvae was analysed and the results of the contents were compared with each other. The average representation of polyunsaturated fatty acids (PUFAs) in the larvae was 7.06%, and we observed an increase in total PUFAs with increasing concentration of insect meal content in the feed mixture. The mean total PUFA content of the control group was 22.21%, the experimental group with 50% insect meal was 15.93% and the experimental group with 100% insect meal was 13.38%. Similar results with increasing concentration were observed for monounsaturated fatty acids (MUFAs). We recorded the lowest value for Black soldier (Hermettia illucens) larvae 15.74% and the highest value for the control group 51.65%, while the experimental groups with 50% and 100% insect meal did not differ much (50% insect meal - 45.49% and 100% insect meal - 44.94%). In the case of saturated fatty acids (SFAs), we observed an increase with increasing insect meal content in the experimental feed mixture. The highest concentration was obtained by the larvae group with 75.36% and the lowest by the control group with 22.90%. Based on the results, we can conclude that the addition of defatted insect meal to the broiler feed mixture, may affect the total fatty acid profile.

#### Keywords: Black soldier fly larvae, insect meal, fatty acids, broilers, protein replacement

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**Contact addres:** Stanislava, Drotárová, Institute of Nutrition and Genomics, Faculty of Agrobiology and Food Resources, Slovak Agriculture University in Nitra, Trieda Andreja Hlinku 2, 949 76 Nitra, <u>xdrotarova@uniag.sk</u>

#### The effect of rumination time on milk yield of dairy cows in early lactation

#### Mária KAPUSNIAKOVÁ, Milan ŠIMKO

#### Supervisor: prof. Ing: Milan Šimko, PhD.

The aim of this study was to show the relationship between rumination time, milk production and subsequently to evaluate the percentage of fat in milk. The experiment was realised at the University farm Kolíňany - farm Oponice. It was carried out to evaluate the influence of the rumination time of high producing Holstein-Friesian dairy cows in the group of early lactation on milk production and composition during 5 - 30 days of lactation. A collar system from BouMatic (Nedap Smarttag Neck) was used to monitor dairy cow activity, recording activity data for 24 hours per day. Data regarding daily milk intake of dairy cows (milked  $3 \times$  daily herringbone type) were recorded and then downloaded using HerdMetrix software. The statistical set included data from the control day of the month (n=24). Statistical analysis of the extracted data relating to the control day of the month indicated that although increased rumination time had a positive effect on milk production, it was not statistically significant (p>0.05). The rationale for this lies mainly in the low number of data from the cows of the milking group, due to the selection of the control day. Dairy cows whose rumination time was under 8 hours per day had an average daily milk yield of 35.20 litres, with rumination time between 8-10 hours the average was around 36.60 litres and cows with rumination time above 10 hours had an average daily milk yield of 49.75 litres. The difference between rumination time under 8 hours and above 10 hours was 14.55 litres of milk. Although increasing the rumination time had a positive effect on milk yield, the percentage of fat decreased. Daily milk yield of cows, which ranged up to 37 litres of milk, did not have a negative effect on decreasing fat content of milk (±4.30%). But at higher milk yield of dairy cows above 50 litres of milk, a decrease in fat percentage was observed as milk density decreased  $(\pm 3.51)$ . The overall effect of rumination time on milk production (0.389; P<0.05) and the effect of daily milk yield on milk fat percentage (0.497; P<0.05) were in medium correlation.

#### Keywords: dairy cows, early lactation, nutrition, rumination time, milk yield

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**Contact address:** Mária Kapusniaková, Milan Šimko, ÚVG FAPZ, xkapusniakov@uniag.sk, milan.simko@uniag.sk

#### Analysis of vitamin C content in samples of young barley extract

#### Kateřina KŘIŠTOFOVÁ, Tomasz SAWICKI, Matej POSPIECH

Supervisor: doc. MVDr. Matej Pospiech, Ph.D.

Young barley is a green food used in human nutrition as a dietary supplement. It is the dried juice of the leaves of young barley, which is classified as a superfood mainly because of its high content of vitamins C, E and B vitamins, and minerals such as Ca, Mg, Fe, K, Na, Zn and Cu. With the increasing concentration of free radicals in the diet, there is a need to increase the in takeof substances with antioxidant activity to ensure a balance between oxidants and antioxidants. One of the important antioxidants in diet is vitamin C, which plays an important role in protecting cells from caused by oxidative stress. The aim of this study was to analyse the vitamin C content of extracts of young barley leaves available on the market in Czech Republic. The samples were mixed with 5% metaphosphoric acid, vortexed and placed in an ultrasonic water bath. This procedure was repeated several times. The extracts were analysed using an HPLC system (LC200; Eksigent, Canada) coupled with the mass spectrometer. Four samples of young barley in powder form were analysed - young barley with strawberry flavour (SB), travel pack of young barley (TB), classic pack of young barley (CB) and young barley from lower price category (LB). The vitamin C content ranged from  $211.25\pm2.05 \ \mu g/g$  to  $456.03\pm1.91 \ \mu g/g$ . The highest vitamin C content was found in the young barley travel pack sample (TB) –  $456.03\pm1.91 \,\mu$ g/g. This was followed by a sample from a classic pack of young barley (CB) –  $377.93\pm2.19 \,\mu\text{g/g}$  and strawberry-flavoured barley (SB)  $-265.87\pm2.08$  µg/g. The lowest level of vitamin C was determined in the sample of young barley from the lower price category (LB) at 211.25±2.05 µg/g. Statistical analysis showed a highly significant difference (p>0.001) among all the samples analyzed. The ANOVA Tukey HSD test was used. This may be due to the different abundance of substances within the different batches of samples or due to the different production process. The TB and CB samples were from the same manufacturer. Significant differences between these samples may be due to degradation of vitamin C by oxidation - exposure to air oxygen or higher humidity, where the travel pack is packed in 5g sachets, whereas the classic pack is sold in 300g packs. The content of biologically active substances in young barley leaves is variable depends on factors such as soil and climatic conditions. fertilization and or UV irradiation.

#### Keywords: antioxidant, L-Ascorbic acid, green food

Acknowledgement: Work was supported by the IMA VETUNI45\_2023 FVHE project.

**Contact address**: Kateřina Křištofová, Department of Plant Origin Food Sciences, *Faculty of Veterinary Hygiene* and Ecology, University of Veterinary Sciences Brno, Palackého tř. 1946/1, 612 42 Brno, Czech Republic. E-mail: H21281@vfu.cz

### SECTION

### Multifunctional agriculture, environment, landscape architecture and rural development

#### Scientific Conference of PhD Students of FAFR, FBFS and FHLE SUA in Nitra – Proceedings of Abstracts SECTION Multifunctional agriculture, environment, landscape architecture and rural development

# Biochar particle size and feedstock type influence on the basic hydro-physical properties of sandy soil

Natália BOTKOVÁ, Justína VITKOVÁ

Supervisor: Ing. Justína Vitková, PhD.

Our research discusses the positive influence of biochar as an organic soil amendment, particularly in soils with low organic matter and poor structure, such as sandy soil. Biochar is considered an effective and eco-friendly tool for improving various hydro-physical and chemical properties of soil. Biochar is introduced as an organic amendment that can bring about positive changes in soil properties. Sandy soils are often characterized by poor water retention and structure. This study suggests that biochar application in sandy soils can offer economic and ecological advantages for improving soil quality. The study examined several soil parameters, including bulk density, particle density, porosity, saturated hydraulic conductivity, and available water content for plants. The results of the study confirmed previous research findings, indicating that biochar application led to a decrease in bulk density, particle density, and saturated hydraulic conductivity which could be beneficial in reducing water runoff. Additionally, it resulted in a partial increase in available water content for plants and porosity. The study highlights that both the type of biochar (different in feedstock type) used and the particle size of the biochar had an impact on the hydro-physical parameters of the soil. After analyzing and comparing two different types of biochar and three different particle sizes, the study found that the most effective treatment for sandy soil was the biochar produced from willow tree with the smallest particle size (< 125  $\mu$ m). In summary, biochar, when applied to sandy soils with low organic matter, can improve soil properties such as bulk density, water retention, and porosity. The choice of biochar type and particle size plays a significant role in determining the effectiveness of this soil improvement technique, with fine biochar particles from willow tree being identified as the most effective in this specific study.

**Keywords:** *biochar, sandy soil, particle size, plant available water content, saturated hydraulic conductivity, soil properties* 

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Contact address: Natália Botková<sup>1,2</sup>, Justína Vitková<sup>1</sup>

<sup>1</sup> Institute of Hydrology, Slovak Academy of Sciences, Dubravska cesta 9, 841 04 Bratislava – Karlova Ves, Slovakia, botkova@uh.savba.sk

<sup>2</sup> Institute of Landscape engineering, Faculty of Horticulture and Landscape engineering, Hospodarska 7, 949 01 Nitra – Zobor, Slovakia
#### Scientific Conference of PhD Students of FAFR, FBFS and FHLE SUA in Nitra – Proceedings of Abstracts SECTION Multifunctional agriculture, environment, landscape architecture and rural development

#### Essential oils as a repellent and antifeedant for slugs under laboratory conditions

#### Mubarak ABDELRAHMAN SALIM EISA, Ľudovít CAGÁŇ, Olha MATSERA, Ali ZESHAN

Supervisor: prof. Ing. Ľudovít Cagáň, CSc.

The plant-based biopesticides as repellents and antifeedants of animal's pest, have been used for several years in traditional method as a useful the human, in their animals and crops protection measure against pests. Development of novel biopesticides based on plant secondary metabolic substances, are wide range of ideal properties, such as low mammalian toxicity, high target toxicity, low cost and eco-friendly. The current study evaluated the potency of five essential oils, Ocimum basilicum L., Curcuma longa L., Allium sativum L., Eucalyptus globulus Labill and Lavandula angustifolia Mill, for their repellency and antifeedants activities against the slugs. A 0.2%, 0.5% and 1% exposed concentrations, was prepared 10ml of each solution was dosed on a piece of fresh lettuce leaves was offered to the slugs in plastic boxes (59.2cm\*39.7cm\*57.7cm). The lettuce leaves were treated with 1ml of tested EOs was placed in the treated side. A further of untreated was included in control side. Each were replicated three times. Our results showed that, the choice bioassay of five EOs against the slugs revealed the high repellency A. sativum, E. globulus, L. officinalis C. longa and O. basilicum compared their untreated control. An additional antecedent analysis pointed out that, among the most feeding deterrence EOs, E. globulus, A. sativum, L. officinalis, O. basilicum and C. longa. It is concluded that, this study strongly suggests the use of five EOs O. basilicum, C. longa, A. sativum, E. globulus and L. officinalis as a biopesticides to control slugs under laboratory condition and environmentally safe.

Keywords: Essential oils, slugs, repellents, antifeedants, eco-system

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**Contact address:** Mubarak Abdelrahman Salim Eisa, Ľudovít Cagáň, Olha Matsera, Ali Zeshan, Slovak University of Agriculture, Faculty of Agrobiology and Food Resources, Institute of Agronomic Sciences, Tr. A. Hlinku 2, 949 76, Nitra, Slovakia, <u>xeisa@uniag.sk</u> Olha Matsera, Vinnytsia National Agrarian University, Vinnytsia, Ukraine

#### Scientific Conference of PhD Students of FAFR, FBFS and FHLE SUA in Nitra – Proceedings of Abstracts SECTION Multifunctional agriculture, environment, landscape architecture and rural development

### Digital 3D models and their implementation in architecture, landscape architecture and rural development

#### Ivan MÁLEK, Attila TÓTH

Supervisor: doc. Ing. Attila Tóth, PhD.

This paper aims to identify best practices, tools and methods of implementing digital 3D models in architecture, landscape architecture and rural development in a low-cost setting. Areas being touched upon are architectural objects and sites, their documentation, preservation and reconstruction, their presentation to the public and the education of both students and the public. The aforementioned endeavours are just a few of the areas that are becoming ever more dependent on obtaining and processing digital 3D data. This paper draws from a rich background of cooperation spanning eight years with archaeologists, architects, nongovernmental organisations and universities on digital documentation of landmarks, heritage sites and objects, the practical use of this data for design purposes, presentation and education. The core pursuit is to streamline the data acquisition and processing pipeline, while optimising the cost for both hardware and software. Four presented case studies show the practical implementation of these objectives. In the first case study, the Zobor Monastery in Nitra, photogrammetry served as a method for documenting conservation efforts, precisely quantifying alterations in masonry, and thereby aiding cost control during construction. The second case study, also at the Zobor Monastery, draws on the participation in the development of the "Sedem Pahorkov" ("Seven Hills") application, using augmented reality and explores a new way for presenting historical artefacts and spaces. This application has significantly influenced the contemporary presentation of the monastery ruins. Case study number three draws on the ongoing documentation of archaeological and construction activities at the Hrušov and Oponice castles that have provided valuable insights into the management of long-term projects taking place at evolving heritage sites. Case study number four describes the incorporation of 3D printed models within the pedagogical framework of the Department of Theatre Studies at Masaryk University in Brno and shows another instance of leveraging 3D data to enhance the understanding and presentation of architectural spaces.

### **Keywords:** 3D models, photogrammetry, architecture, archaeology, education, 3D printing, 3D scanning

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**Contact address:** Ing. arch. Ivan Málek, doc. Ing. Attila Tóth, PhD., Slovak University of Agriculture in Nitra, Faculty of Horticulture and Landscape Engineering, Institute of Landscape Architecture, Tulipánová 7, 949 76 Nitra, Slovakia, ivan.malek.arch@gmail.com.

#### Scientific Conference of PhD Students of FAFR, FBFS and FHLE SUA in Nitra – Proceedings of Abstracts SECTION Multifunctional agriculture, environment, landscape architecture and rural development Long-term effect of biochar application on soil reaction

Melinda MOLNÁROVÁ, Ján HORÁK

Supervisor: doc. Ing. Ján Horák, PhD.

The field experimental project, ongoing since 2014 in Dolna Malanta, is focused on assessing the impact of biochar on soil properties. Biochar was applied to all plots except control in 2014. In 2018 biochar plots were divided to halves – one half with the initial biochar reapplication and the other half with biochar reapplication at the same dose as in 2014. The applied biochar had a higher pH (8.8) than the pH of the soil (5.6). This experiment consists of a control (B0) and variants with biochar application of 10 and 20 t/ha (B10, B20) and reapplication (reappl. B10, reappl. B20) in combination with three levels of nitrogen fertilization (N0, N1, N2). Level of fertilization depended on crops which were planted during the studied period 2021 - 2023. Soil samples from which the pH (KCl) was determined were taken once a month from a depth of 0 - 10 cm. The application and reapplication of both levels of biochar (10 and 20 t/ha) increased soil pH (in all years) compared to control variants without biochar application. An exception were biochar variants without fertilization in 2021 and 2022. In 2021, the biggest difference was observed in B10N1 variant at first level of fertilization with reapplied biochar and variant reappl. B20N2 at second level of fertilization with reapplied biochar when compared with control variant. The highest increase of soil pH in 2022 was measured in variant B10N1 at first level of fertilization with single biochar application and the variant reappl. B20N2 at second level of fertilization with reapplied biochar. In 2023, the soil pH increased also in variants without fertilization. Significant difference (P < 0.05) was recorded in variant reappl. B20N0 with reapplied biochar and B20N0 variant with single biochar application. At the first level of fertilization, the best results were observed in variant B10N1 with single biochar application at 10 t/ha and in variant reappl. B10N1 with reapplied biochar at the first level fertilization. The highest increases in 2023 were observed at the second level of fertilization with reapplied biochar (reappl. B10N2 and reappl. B20N2). In conclusion, considering the observed significant differences in the years 2021 - 2023, the biochar variants at the second level of fertilization demonstrated the stable trend in increasing the soil pH. Based on these results, it can be concluded that the biochar application to the soil can be one of the possible alternative ways to solve problematic soils with low pH.

#### Keywords: field experiment, biochar, reapplication, soil, fertilization

Acknowledgement: Work was supported by the Scientific Grant Agency, grant number VEGA 1/0116/21 and the Slovak Research and Development Agency under the contract No. APVV-21-0089.

**Contact address:** Ing. Melinda Molnárová, Slovak University of Agriculture in Nitra, Hospodárska 7, 949 76 Nitra, Slovakia, <u>xmolnarova@uniag.sk</u>, doc. Ing. Ján Horák, PhD., Slovak University of Agriculture in Nitra, Hospodárska 7, 949 76 Nitra, Slovakia, <u>jan.horak@uniag.sk</u>

#### Scientific Conference of PhD Students of FAFR, FBFS and FHLE SUA in Nitra – Proceedings of Abstracts SECTION Multifunctional agriculture, environment, landscape architecture and rural development Use of leaf water potential monitoring in irrigation comparison

#### Oliver OBROČNÍK

Supervisor: prof. Ing. Viliam Bárek, CSc.

In our study we used the measurement of water potential using a pressure chamber, comparing the efficiency of two types of irrigation, namely double drip irrigation and micro-spray irrigation. For the aim of managing irrigation, the water potential has been frequently employed as a plant water status indicator. The straightforward infrastructure required for its assessment and its direct connection to fundamental physiological processes in plants have all contributed to the methodology's appeal. The amount of water that is present in a plant's leaves is measured by its leaf water potential. Its definition states that it is the water in a leaf's potential energy compared to pure water at atmospheric pressure and temperature. A tool known as a pressure chamber is used to calculate the potential of leaf water. The pressure chamber is used to apply air pressure to a leaf, with the majority of the leaf contained inside, but with a small portion of the petiole exposed to the outside of the chamber via a seal. The amount of pressure required for water to appear at the petiole's cut surface indicates the amount of tension the leaf is under with regard to its water; a high pressure indicates a high tension and a high level of water stress. Megapascal (MPa) was used as the unit of pressure measurement. In our experiment, we observed 10 royal walnut trees, divided into two rows of 5 trees each. The first row was irrigated with drip irrigation, the second row was irrigated with micro-spray irrigation. In total, we made three measurements, namely 14.6.2023, 27.6.2023 and 6.7.2023. Each measurement consisted of taking 1 leaf sample from the monitored trees, followed by analysis using a pressure chamber. Irrigation was started on 14.6. and 27.6. During the monitoring we found that on 14.6.2023 the drip irrigation series had on average the same results compared to the microspray irrigation. On 27.6.2023 the drip irrigation results were 7.69% better compared to the micro-spray and on 6.7.2023 the drip irrigation results were again 5.89% better. From the results, we found that monitoring water potential using pressure chamber is a suitable method for comparing different types of irrigation systems and can also be used in precise irrigation management.

### **Keywords:** *irrigation, drip irrigation, water potential, micro-spray irrigation, leaf water potential*

Acknowledgement: This the study was supported by the Slovak Research and Development Agency on the basis of contract no. APVV 20 0071, APVV 15 0562 and VEGA 1/0300/22.

Contact address: Oliver Obročník, Hospodárska 7, Nitra., oliverobrocnik@gmail.com

#### Scientific Conference of PhD Students of FAFR, FBFS and FHLE SUA in Nitra – Proceedings of Abstracts SECTION Multifunctional agriculture, environment, landscape architecture and rural development Ichthyological survey of Slaná river in 2022

#### Andrej SEMAN

Supervisor: doc. Ing. Jana Ivanič Porhajašová, PhD.

In the middle of february 2022 was observed pollution of the Slaná river by the flowing mine water. This caused anthropogenic, industrial, point pollution with sublethal effects. The pollution is visible on a section of the river with a length of tens of kilometers. Visible signs of pollution downstream, it means the ferric coloration, turbidity of the water and the presence of ferric sediments, disappear due to the chemical and sedimentation processes, as well as dilution by numerous tributaries. About a month before the survey was carried out, the concentration of dissolved substances was reduced by approximately 80% by the intervention of the Mining Rescue Service. Despite this, an ocher turbidity was visible in the investigated locations below the mine water discharge point. According to media reports, there was significant damage to ichthyocenoses, despite the fact that no mass death of fish was observed. The goal of the ichthyological survey was to find out the current state of ichthyocenoses in relation to pollution from mine water, which also corresponded to the choice of locations. The ichthyological survey was carried out at three locations. One location was located above the source of pollution and two locations below the source. The survey was carried out by the electrofishing method using two fishing units proceeding in parallel. Each location was fished once. Subsequently, the determination and quantification of the catch took place together with the measurement of the total body length. The aim was to determine the presence, abundance and age representation of individual of fish species and ringmouths at all three locations. A decrease in species diversity, low densities due to the watercourse character and a subverted age structure with the absence of older years were found in the affected localities. The condition of ichthyocenoses improved in direct proportion to the distance from the point of discharge of mine waters. An ichthyological survey confirmed suspicions of a significantly negative impact of the discharge of contaminated mine waters on ichthyocenoses in the affected section of the Slaná River.

#### Keywords: fish, water bodies, Slaná river, ichthyological survey

Acknowledgement: Ichthyological survey was supported by Water research institute, Water and fish-Society for protection of aquatic biotopes of Slovakia NPO, Slovak angling association, Slovak karst national park administration.

**Contact address:** Andrej Seman, Slovak University of Agriculture in Nitra, Faculty of Agrobiology and Food Resources, Institute of Plant and Environmental Sciences, <u>andrej.seman@gmail.com</u>

#### Scientific Conference of PhD Students of FAFR, FBFS and FHLE SUA in Nitra – Proceedings of Abstracts SECTION Multifunctional agriculture, environment, landscape architecture and rural development

### Modeling the impact of green infrastructure implementation on surface runoff: Case study of Lublin, Poland

Kostiantyn SOKOLCHUK, Jarosław ŚLIZAK

Supervisor: doc. Ing. Marek Sokáč, PhD.

The purpose of this study is to model the impact of the implementation of green roofs and permeable pavements on the water runoff in the stormwater network. This type of research is relevant in the context of developing plans for individual districts, reducing the risks of negative hydrological phenomena, in particular those caused by development and climate change. The object of the study was one of the districts of the city of Lublin, Poland. The selected area is located in the districts of Sławinek, Helenów and Wieniawa, the rainwater flows into the Czechówka River. The system under consideration is divided into three separate parts, each with an independent outlet. The total area is 76.4 hectares; territory has a significant elevation difference, which accelerates the speed of floods. The modeling was carried out using SWMM software. For this research, a simulated heavy rain event lasting 90 minutes with one peak was used. Territory was divided into subcatchment areas, each of them was classified according its development type and in order to determine the percentage of impervious surface. Studied area is dominated by multi-apartment buildings, which account for more than 50% of the total area, followed by road surfaces. Three scenarios were modeled in this study: a baseline scenario under existing conditions, a scenario with the implementation of green roofs (scenario 1), and a scenario with the implementation of both green roofs and permeable pavements (scenario 2). The green roofs scenario 1 assumes their implementation on about 6.3% of the entire catchment area, or 12% of the area occupied by multi-family buildings, as well as on a part of service buildings. The second scenario considers additional partial installation of the permeable pavement, on 2.1% of the total area, bringing the total area of the transformed territory to 8.4%. The changes affect 158 subcatchments of 756. The analyzes of the results show that the implementation of green LID to stated extent might reduce the peak runoff in the outfalls: by 10.4% in scenario 1 and 15% in scenario two for outfall 1, which collects water from 64% of the area. For the second largest area, 33% of the total, the reduction in peak flood runoff is lower, 6.9 and 13%, respectively. However, there is still a potential for increasing the area of LID application. Similar patterns are observed on other analyzed links and nodes, located in the center of the study area. The peak flood runoff decreased most significantly at the outfall with the smallest catchment area, by 11.9 (scenario 1) and 31% (scenario 2). This is due to the fact that in the proposed model, more than 19% of this district's territory is treated with green infrastructure, 6.2% is occupied by green roofs and 13% by permeable pavement. The time of the flood peak almost does not change, which can be attributed to both the relatively short length of the network and the 5 minute interval used in the modeling. On average, green infrastructure can reduce the runoff coefficient in catchments where it is implemented by 28%, in some cases the difference can be up to 36.5% with green roofs alone and exceed 50% when both green roofs and permeable surfaces are implemented in a catchment. In absolute terms, the largest drop was from 0.87 to 0.55 for a small catchment with paved roads. Therefore, the introduction of green infrastructure can significantly reduce the peak flood by reducing the runoff coefficient from catchments. In the future, the results will be refined using real precipitation data, expanding the variety of green infrastructure and the area of its implementation.

Keywords: green infrastructure, urban hydrology, surface runoff, storm drainage systems

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**Contact address**: Institute of Hydrology, Slovak Academy of Sciences, Dubravska cesta 9, 841 04 Bratislava, Slovakia, sokolchuk@uh.savba.sk, Institute of Landscape engineering, Faculty of Horticulture and Landscape engineering, Hospodarska 7, 949 01 Nitra, Slovakia

#### Scientific Conference of PhD Students of FAFR, FBFS and FHLE SUA in Nitra – Proceedings of Abstracts SECTION Multifunctional agriculture, environment, landscape architecture and rural development

#### Agrokomplex – A multifunctional component of the urban landscapes of Nitra

Zuzana VINCZEOVÁ, Roberta ŠTĚPÁNKOVÁ, Attila TÓTH

Supervisor: doc. Ing. Attila Tóth, PhD.

Urban green spaces of residential areas and zones represent an essential component of urban landscapes. They provide important recreational ecosystem services for residents as publicly available and accessible open spaces. Furthermore, urban green spaces represent the primary contact for residents with nature, various opportunities for social interaction and inclusion. Due to a growing urbanisation and construction development in cities, urban green spaces can potentially be threatened, and their overall area can be reduced. Therefore, urban landscape and green space planning is becoming more and more important and crucial in towns and cities, to safeguard available and accessible open green spaces for people. Besides existing urban green spaces, there are various unused, underused, or even abandoned areas that have a high potential to provide residents with new resources and additional spaces for recreation and everyday use as public or semi-public open spaces. These can be for instance abandoned industrial areas and sites (usually referred to as brownfields) or complexes built for a specific purpose and function, that has partly or fully vanished over time. This paper elaborates on Agrokomplex National Exhibition Centre in Nitra as an interesting case study with extensive open spaces in the urban fabric of the city. The exhibition centre has large green and blue spaces with a high recreational potential, which is currently not fully utilised. The green spaces of Agrokomplex currently function as specialised institutional semi-public open spaces with only a limited access to the public. The presented research assesses the potential of Agrokomplex to be transformed into a more accessible and inclusive public or semi-public open space for inhabitants of Nitra in general, and for the residents of the surrounding urban district of Chrenová in particular. The main research method applied in this study was research by design. We have identified and selected open spaces within the overall area of Agrokomplex, which are in the immediate vicinity of the Chrenová urban district and as such have a high potential for providing ecosystem services as additional residential green spaces. In the process of research by design we worked with different transformation scenarios, which resulted in a design proposal. This result can be used as an inspiration and initiator of discussions and negotiations between the exhibition centre and the city of Nitra to form a vision and a transformation strategy that could enhance the quality of life of the inhabitants of Nitra and residents of the Chrenová urban district.

**Keywords:** green infrastructure, urban green spaces, public and semi-public open spaces, landscape architecture, research by design

Acknowledgement: This paper builds upon the master thesis of the first author and is an outcome of the following educational and research projects: KEGA 004SPU-4/2023 KR:EK:IN - Landscape Economy for Innovative and Sustainable Interdisciplinary University Education in Slovakia; BIN SGS02\_2021\_013 ReImaGIne: Research and Implementation of Green Innovations in Landscape Architecture.

**Contact address:** Ing. Zuzana Vinczeová, <u>xvinczeovaz@uniag.sk</u>, doc. Ing. Attila Tóth, PhD., <u>attila.toth@uniag.sk</u>, Institute of Landscape Architecture, FHLE, SUA Nitra, Tulipánová 7, 949 76 Nitra, Slovakia

#### Scientific Conference of PhD Students of FAFR, FBFS and FHLE SUA in Nitra – Proceedings of Abstracts SECTION Multifunctional agriculture, environment, landscape architecture and rural development The potential of historical urban gaps for green solutions

#### The potential of historical urban gaps for green solutions

#### Tímea ŽOLOBANIČOVÁ, Roberta ŠTĚPÁNKOVÁ

Supervisor: doc. Ing. arch. Roberta Štěpánková, PhD.

Historical urban gaps represent a unique architectural and cultural heritage that often plays a crucial role in defining a city's identity. However, as the demands for sustainable urban planning continue to rise, along with the challenges posed by climate change, there is a growing need to enhance the utilisation of these historical spaces. Our research, which explores the untapped potential of historical urban gaps for sustainable solutions in urban environments, with a particular emphasis on the landscape and its rich historical legacy. Historical alcoves have the potential to become focal points for sustainable urban solutions across various dimensions, including:

Ecological Restoration: Research identifies methods to rejuvenate greenery within these premises, with a strong emphasis on preserving biodiversity and the use of environment.

Cultural and Community Revitalisation: Research discusses strategies for integrating cultural and community activities into historical alcoves, thus promoting local identity, and fostering social sustainability.

Climate Change Adaptation: Research explores strategies to adapt historic coves to climate change impacts, including flood resilience and mitigating extreme temperatures.

The result is that historical alcoves can serve as crucial elements in the transformation of cities into sustainable and resilient urban environments, especially within the historical city centre.

Lost places as the phenomenon, when reimagined and repurposed, can become focal points for urban renewal. They offer unique opportunities for cultural preservation, adaptive reuse, and sustainable development. Our examination of lost places extends the conversation about urban sustainability beyond the familiar landmarks and into the hidden corners of our cities. As urbanisation continues to intensify, these often-overlooked historical spaces can play a vital role in mitigating the adverse effects of urban sprawl and climate change. Research offers valuable insights and innovative solutions that honour the past while paving the way for a greener and more sustainable future for cities with rich historical legacies.

Keywords: lost spaces, urban gap, sustainability, public greenery, revitalisation

Contact address: Ing. Tímea Žolobaničová, SUA in Nitra, FHLE, ILA, Tulipánová 7, 949 76 Nitra, Slovakia

### SECTION

### **Plant Production**

# Influence of the variety and biostimulant Excel Grow on the yield and quality of sugar beet

#### Nika BRIEDIKOVÁ

Supervisor: prof. Ing. Vladimír Pačuta, CSc.

The production of sugar from sugar beet is currently the last food vertical in which the Slovak Republic is self-sufficient. Sugar beet cultivation and sugar production have a long tradition in European countries and represent 20 - 30% of global sugar production. For its optimal growth, sugar beet needs soil with a pH of 6.8 - 7.3, enough heat, light and moisture, soil rich in nutrients (nitrogen, phosphorus, potassium, sulfur, boron, manganese, magnesium, calcium). Sugar beet is a crop that is very sensitive to abiotic stress. With the ever-changing climatic conditions, the breeding process is more difficult and choosing the right variety for the given conditions is crucial. Many active substances used to protect sugar beet stands have been banned and will continue to be banned. That is why the use and influence of organic preparations is important for the future cultivation of sugar beet. Biostimulator ExelGrow® is a natural product based on fermented seaweed Ascophyllum nodosum, which supports the growth and development of crops. It should make it possible to increase the quantity and quality of plant production. ExelGrow® should be a tool for increasing photosynthesis, improving nitrogen absorption and utilization, and also serves to alleviate the effects of daily abiotic stress. Together with the selection of the right variety for the given climatic conditions, the combinations should ensure the economic efficiency of sugar beet cultivation. The experiment of the Institute of Agronomic Sciences is carried out on the soils of the Dolná Malanta experimental base and is based on the method of divided blocks in three repetitions. The main goal of the experiment is to evaluate the influence of the variety and the selected biostimulator on the yield and quality of sugar beet. In the experiment, two certified monogerm varieties of sugar beet 'Fabius' and 'Fischer' and the seaweed-based biopreparation Excel Grow were used. The results of the experiment were influenced by various factors such as year, variety, application of the biopreparation compared to the control variant and repetition. In 2021, we monitored the effect of the variety on individual parameters - yield and sugar content. A highly statistically significant influence of the variety (p<0.01) on sugar content and sugar beet yield was demonstrated. Since 'Fabius' is a normal-sugary variety and 'Fischer' is a sugary variety, the sugary variety had better quality results and the normal-sugary variety achieved a higher yield. The experiment also monitored the difference between the variant where the biostimulant was used and the control variant. From the obtained data, we evaluated that the Excel Grow biostimulant used had a statistically significant effect on the quality of sugar beet (p<0.05), but only for the normalsugary type of variety. The effect was noted on the yield of white sugar and on the yield of polarizing sugar. We did not notice any demonstrable effect on the yield of white sugar for both varieties and the quality of the sugary variety. Likewise, no demonstrable effect on the height of the harvest was recorded for any of the varieties. Based on the results obtained from the 2021 trial, we recommend for science and cultivation practice the selection of the right variety for the growing conditions, and for the normal-sugary type of the variety, use the Excel Grow biopreparation if it is a problem to achieve the sugar content required by the processors. The correct selection of the variety together with the use of biopreparation can increase the quality of sugar beet and thus also ensure a better economic output for the cultivation practice as well as for the processors.

Keywords: sugar beet, variety, biostimulant, yield, quality, sugar content.

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Contact address: Nika Briediková, SPU Nitra Trieda Andreja Hlinku 2, 949 76 Nitra- Chrenová, xbriediková@uniag.sk

# Analysis of genetic diversity in lavender (*Lavandula angustifolia* Mill.) grown in different regions of Slovakia using RAPD markers

#### Simona ČERTEKOVÁ

Supervisor: prof. Ing. Katarína Ražná, PhD.

Known for its fragrant purple flowers, lavender is aromatic herb which belongs to Lamiaceae family. It is popular mainly for its pleasant and soothing fragrance and has a many practical uses mainly in aromatherapy, cosmetics and gastronomy. Understanding plant genetic diversity is critical for conserving biodiversity, promoting sustainable agriculture, enhancing climate resilience and identifying its added value. Molecular markers represent an effective tool in addressing these challenges. In this work Randomly Amplified Polymorphic DNA (RAPD) technique was implemented for lavender diversity screening depending on the soil and climatic conditions of Slovakia. Plant material was collected from local farms in Zbehy, Poriadie, Dolná Breznica, Trenčín, Tomášikovo, Vištuk, and Malé Leváre, encompassing four varieties of L. angustifolia Mill. (Hidcote, Munstead Mailette, Krajova) and two varieties of L. x intermedia Emeric ex Loisel. (Grappenhall, Grosso). Applied analysis utilized representative samples of L. angustifolia var. Hidcote, including tissues originating from leaves, stems, and flowers, collected from seven different localities. We applied a set of 20 different RAPD primers designated as OPB01 - OPB20. Varying amplification profiles were observed with primers OPB11 and OPB18. The total number of amplified fragments was 141 for OPB18 and 125 for OPB11, with an average of 8 and 7 amplicons per sample, respectively, however no differences in DNA profiles were observed in the context of the geographic origin of the lavender samples. Unique profiles were observed in samples obtained from leaves from plants collected in Zbehy and Vištuk for primer OP11, and in leaf and stem samples collected in Poriadie and Vištuk when using primer OPB18, respectively. These DNA fingerprints, represent preliminary results and will be part of a genetic fingerprint database, which will serve as a valuable resource for understanding the genetic makeup of lavender and its potential implications for cultivation and environmental adaptation.

#### Keywords: lavender, genetic diversity, DNA polymorphism, RAPD

Acknowledgement: VEGA 1/0749/21 Environmentálny skríning premenlivosti sekundárnych metabolitov rastlinných prírodných zdrojov v pôdno-klimatických podmienkach Slovenska.

**Contact address:** Simona Čerteková, Institute of Plant and Environmental Sciences, Faculty of Agrobiology and Food Resources, Slovak University of Agriculture in Nitra, xcertekova@uniag.sk

#### Screening the effects of various light spectra in collection of microgreens

Lucia JASENOVSKÁ, Marek ŽIVČÁK

Supervisor: doc. Ing. Marek Živčák, PhD.

Currently, there is an increase in the cultivation of plants and crops in greenhouses and controlled agricultural environments using light-emitting diodes. Cultivation light conditions, such as spectral composition, light intensity and photoperiod, can affect the photosynthetic apparatus, including the content of beneficial bioactive compounds. The experiments focused on screening a collection of microgreens (21 genotypes of various species) cultivated in three light environments: illumination provided by narrow-band red LEDs, blue LEDS (470 nm) and broad-band white LEDs with the same light energy input. The responsiveness to light spectra was assessed based on conventional traits, such as fresh and dry weight, total chlorophyll and carotenoid contents and non-invasive traits associated with contents of specific compounds, such as fluorescence excitation ratios. In the white light environment, we observed a higher fresh weight compared to monochromatic environments, especially compared to blue light. Blue and white light had a positive effect on the concentration of chlorophyll and carotene in plants compared to red light. Moreover, blue light was associated with the highest values of chlorophyll excitation ratios, indicating a significant increase in the contents of flavonoids and anthocyanins. However, individual microgreens responded differently, which was observed in all assessed traits, especially in fluorescence ratios, but we also observed the clustering of microgreens with similar responses to unequal LED light spectra. In conclusion, in most plant species, multispectral white LEDs positively influenced quantitative and qualitative traits compared to the most frequently used red LEDs. Blue light slightly suppressed growth but improved quality, which might be a beneficial response due to the increase in the period in which microgreens can be harvested. Nevertheless, some species responded differently, emphasizing the need to optimize the light conditions to improve microgreens production and nutritional value.

**Keywords**: *light spectrum, light-emitting diodes, microgreens, photosynthesis, pigments, fluorescence* 

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**Contact address**: Ing. Lucia Jasenovská, Institute of Plant and Environmental Sciences, Faculty of Agrobiology and Food Resources, Slovak University of Agriculture in Nitra, xjasenovska@uniag.sk

#### Preliminary results of rhizome regeneration of the quarantine weed Sorghum halepense

#### Nikola KOTLÁROVÁ

Supervisor: doc. Ing. Pavol Eliáš, PhD.

Sorghum halepense (L. Pers.) is a global weed that can cause significant reductions in summer crop production and invades large areas of the world. It is a perennial C4 grass native to Eurasia that reproduces by rhizomes and seeds. It is mostly associated with areas of high humidity, such as along irrigation canals, cultivated fields and field margins. Infested crops have drastic yield losses with secondary problems due to the influence of Sorghum halepense (L. Pers.) as an alternative host for diseases and pests. Sorghum halepense (Pers.) L. has spread into Slovakia via the Elbe route and is now mainly found in numerous localities in the Danube Lowland and in the south-east of the Slovak Republic. Due to changes in temperature conditions associated with climate change, this species is spreading from the south to the north of the country. The aim of the work was to verify the regeneration capacity of differently long fragments of underground outcrops (vegetative reproduction). In the locality of Zlaté Moravce (the Podunajská nížina lowland, SW Slovakia) we sampled rhizomes of Sorghum halepense (Pers.) L. We cut the sampled shoots into segments with one and two nodes (containing regeneration meristems) and tested the rate and success of regeneration at different temperatures. At 20 °C and 50% humidity, we found that 10% of the small rhizomes regenerated and 16.6% of the large rhizomes regenerated. At 25 °C and 50% humidity, 23.33% of small rhizomes and 40% of large rhizomes were able to regenerate. At the highest temperature of 30 °C and humidity of 50%, 10% of the small rhizomes and 26.6% of the large rhizomes regenerated. We found that the optimum temperature for proliferation and regeneration of Sorghum halepense (Pers.) L. is 25 °C. The effects of climate change are strongly influencing the spread of Sorghum halepense (Pers.) L., invading new areas and increasing its environmental range. Therefore, it can be argued that further spread may cause serious agricultural problems in central Europe.

Keywords: Sorghum halepense, weeds, rhizomes, regeneration

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Contact address: Nikola, Kotlárová, SPU Nitra Trieda Andreja Hlinku 2, 949 76 Nitra-Chrenová, xkotlarova@uniag.sk

#### Stability of organic carbon in the soils in forest ecosystems

#### Martina KUNKELOVÁ

Supervisor: prof. Ing. Erika Tobiašová, PhD.

Soil organic matter is stabilized in soil through two basic mechanisms: physical protection within aggregates and chemical stabilization. The experiment was carried out on various soil types that are used as arable land and in the forest ecosystem. From the monitored parameters of soil organic matter it was total organic carbon (TOC), labile carbon ( $C_L$ ), carbon lability ( $L_C$ ), cold (CWEOC) and hot (CWEOC) water extractable organic carbon and ratio of labile carbon and labile nitrogen (C<sub>L</sub>/N<sub>L</sub>). Regarding chemical properties, it can be stated that the most significant influence on the stability of organic matter is the pH, i.e., acidity of the soil. For all four parameters (CWEOC, HWEOC, CL, CL, CL, CL/NL), we observed a positive correlation (P < 0.05) with hydrolytic acidity (respectively a negative correlation with saturation of the sorption complex with basic cations) and, except for C<sub>L</sub>/N<sub>L</sub>, also a negative correlation with pH. For all parameters of soil organic matter, higher values have been recorded in the forest ecosystem, where the pH values are also significantly lower than on arable land. From the soil types, the highest C<sub>L</sub> values were recorded in Eutric Gleysol, followed by Haplic Luvisol, Eutric Regosol, Mollic Fluvisol, Distric Stagnosol, Haplic Chernozem, Eutric Fluvisol, which also copies the values of the C<sub>L</sub>/N<sub>L</sub> ratio. In the case of C<sub>NL</sub>, the highest values of this parameter were in Mollic Fluvisol, and then in Eutric Gleysol. For other soils, differences between cultivated soils were minimal, so the order was mixed up by the influence of the forest, especially its vegetation cover. Haplic Luvisol followed with a smaller vegetation cover of young oak stands such as Haplic Luvisol, with older acacia-beech stand, but also with less vegetation cover. In case of these soils, the labile components were also more abundant. The forest under the Eutric Regosol, despite the extremes in the granular composition of this soil, was characterized by a relatively high proportion of labile and stable components. It was an older, dense stand of mixed forest dominated by beech and about 90% vegetation cover. Therefore, a more acidic pH is, on the one hand, a reflection of the processes of organic matter transformation, and, on the other hand, it conditions the formation of a certain community of soil organisms, and thus the character of reactions and changes in soil organic matter. The parameters of CWEOC and HWEOC can be perceived completely differently. CWEOC points to differences in stability respectively lability in ecosystems, whereas HWEOC focuses on differences in soil types. In relation to chemical stabilization, there is an indication of the mechanism of stabilization of organic matter related to soil reaction, where dependencies of several parameters in the acidic pH area have been recorded. In relation to physical stabilization, it is an aggregation mechanism, where the accumulation of labile components occurs primarily in the largest macroaggregates and their subsequent stabilization in the smallest. In relation to soil type, it appears prospective for monitoring the HWEOC mechanism and in relation to the CWEOC ecosystem.

Keywords: stabilization, labile carbon, aggregates, forest soils, soil structure

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**Contact address**: Martina Kunkelová, Institute of Agronomic Sciences, Slovak University of Agriculture, Tr. A. Hlinku 2, 949 76 Nitra, xkunkelova@uniag.sk

# The impact of the variety and biostimulant Naturalny Plon® on the production and quality of sugar beet (*Beta vulgaris* provar. *Altissima* Doel)

#### Dominika LENICKÁ

Supervisor: prof. Ing. Vladimír Pačuta, CSc.

The main objective of the experiment was to evaluate the impact of the variety and selected organic preparation on the production and quality of sugar beet. Sugar beet belongs to the *Chenopodiaceae* family and is an important strategic crop in terms of global sugar production. At present, sugar beet accounts for 20 - 30% of global sugar production. This crop is characterized by the fact that for its optimal growth it needs soil with an optimal pH of 6.8 - 7.3. According to the mechanism of carbon dioxide fixation, sugar beet is included in the C3 group of plants, which means that it has low tolerance of drought and high temperatures, but high efficiency of photosynthesis in temperate zone conditions. For optimal growth and harvest, sugar beet requires enough light, heat and moisture, an abundant supply of nutrients to the soil. This crop is also very sensitive to abiotic stress, which is considered one of the most widespread factors that significantly limits the productivity of beets and the stability of their yields. The field experiment of the Institute of Agronomic Sciences was carried out on the experimental Centre of Plant Biology and Ecology of the Faculty of Agrobiology and Food Resources at Dolná Malanta and was established by the method of split blocks. The experiment included two certified genetically monogerm varieties of sugar beets Lucius and Nicolaus and used a foliar biostimulant based on seaweed Naturalny Plon<sup>®</sup>. The obtained results of the experiment were influenced by various factors such as year, variety, application of the foliar biostimulant compared to the control variant and repetition. During the vegetation season 2021, we monitored the influence of the variety on individual parameters, finding a highly statistically conclusive influence of sugar beet genetic material on sugar content and a yield of white sugar (P < 0.01). However, the sugar beet variety has also been shown to influence the potassium content of beet juice and the  $\alpha$ -amino nitrogen content (P < 0.05). We recorded an inconclusive influence of the sugar beet variety in the harvest of roots, in a harvest of polarizing sugar, in the white sugar crop and we also confirmed an inconclusive effect on the sodium content of beet juice (P > 0.05). In the experiment, we also monitored the effect of the biostimulant and from the obtained data we found that the chosen biostimulant Naturalny Plon<sup>®</sup> had a highly statistically conclusive effect on sugar content and on yield of white sugar (P < 0.01). The effect of the foliar biostimulant on the harvest of roots, on a harvest of polarizing sugar, on white sugar crop and on the potassium content of beet juice (P < 0.05) has been shown to be statistically conclusive. The effect of the biostimulant on sodium content and  $\alpha$ -amino nitrogen content in beet juice (P > 0.05) has been shown to be inconclusive. From the results obtained during the vegetation season 2021, we recommend for science and cultivation practice to work on the development of new and better seeds and biostimulant, as we assume that suitable biostimulant in interaction with suitable varieties of sugar beet could in the future find not only wide application, but also increase the production potential of the crop itself.

Keywords: sugar beet, biostimulant, yield, variety, year, quality

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**Contact address:** Ing. Dominika Lenická, Institute of Agronomic Sciences, Faculty of Agrobiology and Food Resources, Slovak University of Agriculture in *Nitra*, Tr. A. Hlinku 2, 949 76 Nitra, e- mail: xlenickad@uniag.sk

#### Scientific Conference of PhD Students of FAFR, FBFS and FHLE SUA in Nitra – Proceedings of Abstracts SECTION **Plant Production**

#### The role of nitrogen fertilization on fungal colonization and severity of ear rot on selected maize genotypes (Zea mays L.): inoculation of Aspergillus flavus and Fusarium vertcilioides

Muhoja Sylivester NYANDI<sup>1</sup>

Supervisor: Prof. Dr. Petér Pepó (D.Sc.)<sup>2</sup>

Maize is used as food, feed, and raw materials for industries. It is a more versatile multipurpose crop than wheat and rice. In many countries, particularly in SSA, Latin America, and a few countries in Asia, maize is a well-established and significant crop for human consumption and accounts for approximately 20% of food calories. It has a variety of roles as an industrial and energy crop in industrialized economies, where it is largely consumed as a livestock feed crop and, thus, plays an important, diverse, and dynamic role in the global agri-food systems and food and nutrition security. This study conducted a field experiment to assess the interactive influence of agrotechnical factors as nitrogen fertilization on maize hybrids concerning infection and colonization of A *flavus* and F verticilioides fungal colonization and disease development. Using three nitrogen regimes (i.e. 0, 90, and 150 Kg/ha) and three commercial maize hybrids, two maize hybrids with predefined information (tolerant and sensitive) and one undefined information on the sensitivity of the fungal infestation but high yielding. Fertilization indicated aggravated severity at high and low levels on average; however, the variation between hybrids was insignificant. There was no clear optimum for fertilization, although the highest level, N150 kg/ha, indicated the highest severity. Further, A flavus indicated significant toxins production without visible signs of infection compared to F verticilioides. The high-yielding variety with undefined information produced more toxins. Therefore, searching for an optimum fertilization rate and making hybrid sensitivity information available to farmers remains paramount in preparing programs for integrated management.

**Keywords:** Fertilizer; Maize genotypes, resistance, Fusarium verticillioides, Aspergillus flavus, Ear rot disease severity, Food quality

**Contact address:** <sup>1</sup>Kálmán Kerpely Doctoral School, University of Debrecen, 4032 Debrecen, Böszörményi Street 138, HUNGARY, e-mail: <u>muhoja21@mailbox.unideb.hu</u>; <sup>2</sup>Institute of Plant Science, University of Debrecen, 4032 Debrecen, Böszörményi Street 138, HUNGARY.

#### Effect of biostimulant application on the photosynthetic efficiency of maize

Akasairi OCWA, Csaba BOJTOR, Arpad ILLES, Brian SSEMUGENZE, Endre HARSANYI

#### Supervisor: Prof. Endre Harsanyi (PhD)

Abiotic factors are reported to increasingly constrain maize production worldwide. Early detection and amelioration of the effects of abiotic stress permits remediation measures applicable during the critical growth stages of maize. Besides, treatments of maize seeds with microorganisms such as bacteria and fungi are known to ameliorate the effects of abiotic stress by enhancing early establishment of maize. However, because of the complex nature of different maize agro-environments, the microorganism based biostimulants could yield optimal or even suboptimal effects. In this context, the field experiment was conducted at University of Debrecen in 2022 to evaluate the effect of a biostimulant on the vegetative productivity of maize based on chlorophyll fluorescence parameters. Maize seeds treated with Bacillus bacteria (biostimulant) and untreated seeds constituted the treatments. Data was collected on steadystate fluorescence (F'), maximal fluorescence (FM'), maximal photochemical efficiency of photosystem II (PSII) and electron transport rate (ETR) at vegetative, silking and anthesis stages, respectively. The chlorophyll fluorescence parameters; F', FM', PSII, and ETR under Bacillus treated seeds were not significantly (p>0.05) different as compared to the control. Progressively, there was marked reduction in the quantum photosynthetic efficiency and electron transport rate in Bacillus treated seeds at silking-anthesis stage. Non-significant differences in quantum photosynthetic efficiency between *Bacillus* treated seeds and the control suggests an early indication of low performance of the biostimulant. This depicts the importance of application of seed treatments in tandem with other agrotechnical inputs such as irrigation and other foliar fertilizers at critical stages of maize to optimize production.

#### Keywords: Biostimulant, Bacillus bacteria, chlorophyll fluorescence, productivity

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**Contact address:** Akasairi Ocwa (Corresponding author), Institute of Land Use, Engineering and Precision Farming Technology, Faculty of Agricultural and Food Sciences and Environmental Management, University of Debrecen, 138 Böszörményi street, 4032, Debrecen, Hungary. Email: <u>ocwa.akasairi@agr.unideb.hu</u>

#### Weed control in the corn stand

#### Denis ONUFER

Supervisor: doc. Ing. Štefan Týr, PhD.

Nowadays, the portfolio of corn herbicides is quite wide, but the most common active substances are, for example: dicamba, rimsulfuron, nicosulfuron, dimethenamid, pendimethalin and terbuthylazine. The aim of the work was the use of new possibilities of chemical control of weeds and their analysis on plots with sown corn. The regulation of weed species was monitored and the effectiveness of used herbicides with specific active substances applied according to variants (pre-emergent, early-post-emergent and post-emergent) was evaluated, as well. The sub-objectives of the work were as follows: 1. evaluation of the current weediness by the numerous methods on control and treated variants 2. assessment of the effectiveness of the regulatory intervention on herbicide-treated variants 3. assessment of the overall health status of the corn. The experiment was carried out as part of the entire dissertation at the PPD Inovec Volkovce company. The implementation took place on their standard plots with maize sown according to the sowing plan. After an agreement with the agronomist, an area was set aside to be only sown, and not further treated - neither mechanically or chemically. Chemical treatments were carried out individually with the help of a hand sprayer. The implementation of the experiment was in accordance with the methodology of EPPO PP1/181(5). Each variant had an area of untreated control, which was covered with a sheet during herbicide application. Based on the use of available herbicides and their using strategy, the variants were divided into preemergence treatment - immediately after sowing, on the soil, post-emergence up to the 3rd corn leaf and post-emergence treatment up to the 6th corn leaf. These methods of application are used the most in practice and are also sufficiently effective. In addition to the variants with trials, the area was designated for spraying with the spray liquid. During the growing season, the weediness and effectiveness of the individual herbicides treatment were evaluated after their application on the variants uniformly for 7, 14, 21 and 28 days, using the EWRS Bonitation scale. In the 2023 season the herbicides were used in the individual variants as follows: V0: untreated control, V1: Wing P 4.0 l.ha<sup>-1</sup>, V2: Lumax 537.5 SE 4.0 l.ha<sup>-1</sup>, V3: Kelvin Quattro 0.44 kg.ha<sup>-1</sup> + Dash 0.5 l.ha<sup>-1</sup>, V4: Principal Forte 0.44 kg.ha<sup>-1</sup> + Dash 0.5 l.ha<sup>-1</sup>, V5: Casper 55 WG 0.3 kg.ha<sup>-1</sup> + Dash 0.5 l.ha<sup>-1</sup>, V6: Arrat 0.2 kg.ha<sup>-1</sup> + Dash 0.5 l.ha<sup>-1</sup>, V7: Laudis OD 2.2 1.ha<sup>-1</sup>. In the V8 variant (technology of the PPD Inovec company), Callisto 100 SC 1 1.ha<sup>-1</sup> + Milagro 4 SC 1.ha<sup>-1</sup> in combination with Šaman 0.5 1.ha<sup>-1</sup>. For all variants, a water dose of 400 1.ha<sup>-1</sup> was used to obtain the best possible effect. The average yield achieved from each plot where the experiment was carried out was 8.8 ton per hectare. During the season, weed species, such as Chenopodium album L., Anthemis arvensis L., Echinochloa crus-galli L. and winter rapeseed were found in the corn stand. The effectiveness of the used herbicides in variants V1 to V7 compared to the control was 100% and the statistical difference between the variants was not evident, i.e. all used herbicides worked very significantly on the declared spectrum of weeds compared to the untreated control.

Keywords: corn, herbicides, chemical treatment, weed control, Zea mays L., weediness

Contact address: Ing. Denis Onufer, e-mail address: denis.onufer@gmail.com

#### Soil nutrient balance after harvest of winter silage rye fertilized with digestate

#### Jan PAZDERA

Supervisor: doc. Ing. Ladislav Varga, PhD.

Digestates from biogas plants (BPS) are a suitable organic fertilizer for the nutrition and fertilization of winter rye (Secale cereale L.) for silage before sowing or during the growing season, because they are characterized by the presence of all macro- and microelements, with an emphasis on nitrogen and potassium. The field trials were conducted on the land of agricultural farm ZD Nové Město na Moravě, Czech Republic, at an altitude of 594 m above sea level. In two-year pilot field trials (harvests 2021-2022), the interannual effect of digestate fertilization (30 t.ha<sup>-1</sup> before sowing) on yield and selected quality parameters of forage silage winter rye cv. KWS Progas was also assessed. Rye was harvested in both years in the milkdought stage. Agrochemical analyses of the soil before the establishment of the experiment and before digestate fertilization were in 2020 (mg.kg<sup>-1</sup>): P = 87.5, K = 390, Mg = 236.4, Ca – 2920, pH 5.94 and humus 2.24%, and in 2021 (mg.kg<sup>-1</sup>): P – 52.5, K - 263, Mg – 293, Ca – 2650, pH 6.54 and humus 2.28%. The percentage of humus was obtained by calculating the oxidizable carbon content ( $C_{ox}$ ) multiplied by 1.724. The available forms of nutrients in the soil were determined by the Mehlich III method. Determination of available nutrients from soil leachates was carried out as follows: phosphorus by colorimetry, potassium by flame photometry, magnesium and calcium by AAS. Plant material: N by Kjeldahl method, P by colorimetry, K by flame photometry, Mg and Ca by AAS. The chemical composition of the digestate in 2020 was as follows: dry matter content 6.52%, combustible substances content 72.54%, pH 7.66,  $N_{tot} - 0.50\%$ , N-NH<sub>4+</sub> - 0.291%, P - 0.063%, K - 0.569%, Mg - 0.049% and Ca - 0.183% and in 2021: dry matter content 7.12%, combustible substances content 70.79 %, pH 7.82,  $N_{tot}$  0.62%, N-NH<sub>4+</sub> – 0.316%, P – 0.082%, K – 0.565%, Mg – 0.029% and Ca - 0.118%. Dry matter yield of rye was 4.86 t.ha<sup>-1</sup> at 15.63% dry matter content (2021) and 4.17 t.ha<sup>-1</sup> at 16.57% dry matter content (2022) with these nutrients contents (% DM): N - 2.21, P = 0.403, K = 3.09, Mg = 0.102 and Ca = 0.252 (2021) and N = 1.87, P = 0.535, K = 3.28, Mg - 0.089 and Ca - 0.231 (2022). The balance of all determined nutrients (kg.ha<sup>-1</sup>) in our experiment was positive in 2021 (+41.7 N, +19.6 K, +9.7 Mg, +42.5 Ca), except for phosphorus (-0.8 kg.ha<sup>-1</sup>), and in 2022 the balance was positive for all monitored elements (+106.5 N, +2.1 P, +31.7 K, +5 Mg, +25.7 Ca). The residual nutrients in the soil after the winter rye forage harvest will be utilized by the subsequently grown maize in the dual rve-maize system. From the results of the two-year pilot field trials, a digestate rate of 30 t.ha<sup>-1</sup> before sowing winter rye appears to be sufficient in terms of the level of total yield, its quality and a positive balance of nutrients used by the subsequent crop.

#### Keywords: winter rye, silage, digestate, yields, quality, dry matter, nutrient balance

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**Contact adress:** Jan Pazdera, Slovak University of Agriculture in Nitra, Faculty of Agrobiology and Food Resources, Institute of Agronomic Sciences, Tr. A. Hlinku 2, 949 76 Nitra, Slovakia, <u>xpazdera@uniag.sk</u>

### Grape processing technology and its effect on the sensory and analytical parameters of rose wine.

#### Adrián SELNEKOVIČ

Supervisor: doc. Ing. Mezey Ján, PhD.

The aim of the work was to evaluate the influence of maceration length for sensory and analytical parameters in rosé wines. The variants were made from the blue wine grape variety of Cabernet Sauvignon grown in 2022 in the South Slovak wine-growing region, in the village of Mužla and amount of fermentable sugar in the must was 19,70 °BRIX in. The variants were as follows: control variants without maceration and without pectolytic enzymes, one hour maceration for variants I and II and two hours of maceration for variants III and IV. In variants II and IV, pectolytic enzymes were added. The commercial name of the pectolytic enzyme used was Everzym GPC. Maceration was done without cooling. Temperature during fermentation was 18°C and lasted for 6 days. Analytical parameters in wine were determined by FTIR spectofotometry method. Statistical evaluation of variants was evaluated based on LSD tests at the 95% significance level. The highest content of acetic acid was significantly in the variant with longer maceration without the use of enzymes -0.43 g/l in first fermentation analyse and 0.25 g/l in analyse of young wine. Lowest content was statistically significant in the control variant and variants with a shorter maceration time. Variants with one-hour maceration clearly contained less malic acid, compared to variants with longer maceration, or variant without maceration. Use of pectolytic enzymes causes a statistically significant increase in pH - 3.36and 3,25 in the resulting wine. In the statistical evaluation in the content of tartaric acid, we observe that the lowest content was in variant I, while the highest content was in variant III and in the control variant. Variants with longer maceration and the control variant had statistically significant higher content of total acids than variants with shorter maceration. The overall sensory evaluation of the wines was as follows. The best rated was variant II, which reached 86 points, the second was variant IV - 84.5 points. The third was variant III - 82.41 points, the fourth was the control variant - 81.68 points and the worst rated was variant I - 81.23 points. Based on the results, we recommend pre-fermentation maceration in Cabernet sauvignon varieties to produce rosé wine with a duration of one hour with the addition of pectolytic enzymes.

Keywords: rosé, wine, must, maceration, enzymes,

**Contact address:** Adrián Selnekovič, Institute of Horticulture, Faculty of Horticulture and Landscape engineering, Slovak University of Agriculture in Nitra, xselnekovic@uniag.sk

# Selected qualitative parameters after foliar treatment with Selenium in *Brassica oleracea* var. *botrytis*

#### Jakub SITKEY<sup>1</sup>, Martina KUNKELOVÁ<sup>2</sup>, Juraj SAKÁČ<sup>2</sup>

Supervisor: <sup>1</sup>Ladislav Ducsay, <sup>2</sup>Erika Tobiašová

*Brassica* vegetables have been related to the prevention of cancer and degenerative diseases, owing to their a high content of health-promoting phytochemicals. In our case cauliflower (Brassica oleracea var. Botrytis) was evaluated on bio-active substances such as polyphenols content and flavonoids. The small field plot experiment was located in the demonstration gardens of Slovak University of Agriculture in the growing systems of cauliflower (Toledo F1). The experiment comprised 6 variants with 3 replications: a control variant without treatment, a variant with the nitrogen fertilizer LAD or DASA, a variant with a combination of DASA or LAD fertilizer with selenium salt, and a variant with LAD fertilizer and selenium salt in the late growth phase. Selenium salt in the form of sodium selenate in a dose of 50 g.ha<sup>-1</sup> Se were applied six week after planting and before making inflorescence meristem in cauliflower. Harvesting was carried out by multiple thinning. Results of monitoring were statistically evaluated by one-way ANOVA using LDS tests. The highest average of total polyphenolics content was recorded on the variant with the LAD and the lowest values were recorded in the control and the variant with DASA. Overall, in variants with the application of LAD fertilizer with selenium salt and variant with LAD fertilizer and selenium salt in the late growth phase there were recorded decreases in total polyphenolics content compared with variant with the application of LAD fertilizer. On the other hand, in the experiment with broccoli, was found that the application of selenium was a statistically significant increase in the total phenolics content by 11.9% compared to the variant without selenium application [1]. In variants with the application of DASA there were recorded increase the total polyphenolics content. In the case of total flavonoids content the highest overall average was recorded on the variant with LAD fertilizer and selenium salt in the late growth phase. However, in all variants with selenium, there were a tendency to increase the total flavonoid content compared to variants without foliar treatment with selenium. The effect of fertilizers on total phenolic content and flavonoids is contradictory discussed in the various studies but they agree in opinion differences in agronomic characteristics were reflected in diverse phytochemical composition.

#### Keywords: selenium, total polyphenols content, flavonoids

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**Contact address:** Jakub Sitkey, Martina Kunkelová, Juraj Sakáč, Institute of Agronomic Sciences, Slovak University of Agriculture, Tr. A. Hlinku 2, 949 76 Nitra

#### Scientific Conference of PhD Students of FAFR, FBFS and FHLE SUA in Nitra – Proceedings of Abstracts SECTION **Plant Production**

#### Effect of foliar fertilization on NDVI and SPAD of maize (Zea mays L.) hybrids

Brian SSEMUGENZE, Arpad ILLES, Csaba BOJTOR, Akasairi OCWA, Janos NAGY

Supervisor: Prof. Janos Nagy, DSc.

Maize (Zea mays L.) contributes tremendously to human nutrition, though it's production is constrained by abiotic stresses such as drought and soil infertility. Among the amelioration techniques included foliar fertilization. Foliar fertilization maintains optimum nutrition and rapidly corrects nutrient deficiency disorders hence optimizing maize growth. However, environmental factors affect the efficacy of foliar nutrition. Therefore, this study assessed the effect of novel foliar fertilizer product on selected physiological parameters of maize hybrids under water stress conditions. The study was conducted in 2023 at Látókép Experiment Site of the University of Debrecen, Hungary in a randomized complete block design. The treatments assessed were novel foliar fertilizer (consisting of nitrogen (10 g/l), Zinc (8 g/l), K<sub>2</sub>O (8.5 g/l), P<sub>2</sub>O<sub>5</sub> (0.83 g/l) and S (8.93 g/l) and the control on FAO 490 and FAO 290 maize hybrids. Data was collected on NDVI and SPAD at vegetative and reproductive stages respectively. Comparison of foliar fertilizer effect was done using T-test. There were no significant (p>0.05) differences in NDVI and SPAD between the foliar fertilizer and control in all the stages. At the silking stage, SPAD was 44.6 compared to 37.0 in the control, indicating increased SPAD by 20.5%. Similarly, at the silking stage, foliar fertilizer increased NDVI by 20.0%. Although the SPAD and NDVI in foliar fertilizer did not differ from the control, these results suggest the possibility of using the foliar fertilizer to improve maize production.

#### Keywords: Foliar fertilization, physiological parameters, water stress, maize

**Contact address:** Brian Ssemugenze (Corresponding author), Institute of Land Use, Engineering and Precision Farming Technology, Faculty of Agricultural and Food Sciences and Environmental Management, University of Debrecen, 138 Böszörményi street, 4032, Debrecen, Hungary. Email: <a href="mailto:sbrian@mailbox.unideb.hu">sbrian@mailbox.unideb.hu</a>

#### Viability of soybean and sunflower pollen after the application of zinc nanoparticles

#### Lenka TOMOVIČOVÁ

Supervisor: doc. Ing. Ľuba Ďurišová, PhD.

Soybean and sunflower are among the four most important oil seed crops in terms of global oil production. Well-balanced amount of nutrients has an impact on the yield and quality of agricultural crops. In this context, nanofertilizers are becoming a new and effective means of achieving this goal. Zinc is one of the trace elements that has a significant effect on flower formation and pollen quality. The aim of our research was to investigate the effect of zinc nanoparticles on pollen viability of the soybean and sunflower. Three different concentrations of the zinc nanoparticles (Zn-NPs) of 1.4, 14 and 140 mg/L were applied. The pollen viability was evaluated using the IKI test. In this method, potassium iodide detects the starch content, turning the viable pollen brown. High percentage of viable pollen grains was recorded for both crops. While in sunflower the pollen viability was almost the same in all the treatments including the control variant, in soybean we observed a slight increase in the number of viable pollen grains in the treatments with Zn-NPs application. In sunflower, the control sample had 98.45% viable pollen grains. Variant with 1.4 mg/L Zn-NPs had 98.14% vital pollen grains, 98.06% had a variant with 14 mg/L Zn-NPs and 98.85% achieved the variant with 140 mg/L concentration zinc nanoparticles. For soybean, we observed 93.75% of vital pollen grains in the control sample. Samples treated with zinc nanoparticles achieved slightly higher percentage. In the variant with 1.4 mg/L concentration of zinc nanoparticles was recorded 96.70% vital pollen grains, in the variant with 14 mg/L Zn-NPs 95.60% vital pollen grains and variant with 140 mg/L Zn-NPs achieved 95,12% pollen viability. The fluorescence method (FDA test) carried out for pollen germination in vivo and pollen germination method on culture medium *in vitro* will be the subject of further research in detection of pollen grain viability.

**Keywords:** soybean, sunflower, zinc nanoparticles, pollen viability

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Contact address: Lenka, Tomovičová, SPU Nitra Trieda Andreja Hlinku 2, 949 76 Nitra – Chrenová, xtomovicova@uniag.sk

### SECTION

# Technology, quality and safety of raw materials and foodstuffs of animal origin

#### Assessment of appropriate solvents for insects analysis via Raman spectroscopy

Jana ČALOUDOVÁ, Matej POSPIECH

Supervisor: doc. MVDr. Matej Pospiech, PhD.

As the demand for foods containing edible insects rises alongside their relatively higher cost, the likelihood of adulteration grows. Therefore, it is important to seek appropriate detection methods that serve to reliably determine the presence of edible insects in food. This may include Raman spectroscopy, which is an accurate and non-invasive method used in the food industry for quality assessment, compositional analysis, and adulterant detection. It serves as a research tool and helps to detect structural changes during food processing. The aim of the study was to verify of the solvents aplicable for the edible insects detection by Raman spectroscopy. Dried insects were purchased from the market – adults of the house cricket (Acheta domesticus, AD), the superworm (Zophobas morio L., ZM) and mealworm (Tenebrio molitor L., TM). The dried insects were mixed with a blender, then extracted using distilled water, N-hexane and ethanol in a ratio of 1:4. The extraction was performed in centrifuge tubes placed in an ultrasonic water bath for 15 min. Subsequently, the sample was centrifuged at 3000 rpm for 10 min. The supernatant was collected and filtered through a CA 0.45 µm injection microfilter into vials. The sample was analysed using a Raman spectroscope (StellarNet, USA) within the spectral range of 100 to 1000 wavenumbers cm<sup>-1</sup>, employing a 785 nm laser, with each individual sample undergoing five measurements. The data were then statistically evaluated using Microsoft Office Excel and XLSTAT software using principal component analysis (PCA). It has been confirmed that Raman spectroscopy can separate solvent peaks from wavenumbers specific to the insect species detected. The used solvents reached statistically significantly lower intensities than the samples analysed (p < 0.05). The most suitable solvent was distilled water, where the most pronounced distribution of signal peaks was observed, also the best separation of the TM was obtained. The use of the solvents N-hexane and ethanol gave the best discrimination of the AD signal. The use of N-hexane and distilled water was suitable for distinguishing TM and ZM, which are difficult to distinguish due to similar chemical composition within the same family. However, differentiation difficulties between the ZM and the solvent were observed when using ethanol and N-hexane solvents, which could be caused by the high fat content of the ZM. The chosen methodology could be useful in the future for detecting adulteration of food products with declared or not declared insect content. To improve the method, it would be useful to increase the number of samples with different insect species using other especially polar solvents and assessing the influence of the food matrix on detection.

# **Keywords:** *edible insects; extraction; distilled water; ethanol; N-hexane; Tenebrio molitor; Zophobas morio; Acheta domesticus*

**Contact address:** Jana Čaloudová, Mgr. Ing., Department of Plant Origin Food Sciences, Faculty of Veterinary Hygiene and Ecology, University of Veterinary Sciences Brno, Palackého tř. 1946/1, 612 42 Brno, Czech Republic. E-mail: H21289@vfu.cz

#### Identification of game meat using DNA analysis

Adam HANUSKA, Ľubomír BELEJ

Supervisor: doc. Ing. Miroslav Kročko, PhD.

The aim of the research was to identify the species of game meat jerky using a DNA-based technique. Specifically, we used the DNA chip LCD Array MEAT 5.0 (Chipron, Germany). Each of these chips contains 25 species-specific capture probes immobilized on it. These probes allow the simultaneous detection of 17 mammalian species and 7 bird species in different food items. Eight different kinds of game meat jerky were examined in this study. The jerky came from elk, wild boar, deer, kangaroo, roe deer, fallow deer and reindeer. Using a DNA chip, our investigation verified the presence of the reported species in seven of the eight samples of jerky. Elk as an animal species is not listed as a detectable animal species in the instructions for the MEAT 5.0 LCD Array Kit, which may account for the chip's failure to detect any animal DNA in the sample of jerky that came from an elk. As a result, this chip cannot be used to identify elk. At least our investigation has shown that no other unspecified animal species were employed in the production of jerky. In the case of a sample from wild boar and deer, the DNA chip was able to correctly identify the presence of their DNA in the sample, so even if these species were mixed, the chip was reliable. For the jerky samples that contained wild boar as the animal species, the chip evaluated the DNA of wild boar to us as pork because the kit manual states that the chip is capable of detecting wild boar, but the instrument evaluates this under pork. Thus, in the case of wild boar DNA, we cannot determine with certainty whether wild boar meat or pork meat was used in the production of the jerky. We have also confirmed by analysis the suitability of using the chip in the detection of non-traditional game meat such as kangaroo or reindeer meat. The kit manual states that at higher target concentrations and 35 PCR cycles, very weak cross-reactivity between deer and reindeer can occur. No such crossreactivity occurred in our analysis of reindeer jerky. In addition to verifying and confirming the authenticity of the jerky (excluding elk), the analysis we performed also verified and confirmed the suitability of using this DNA chip for the analysis of selected game meats and jerky. Therefore, it can be said that the LCD Array MEAT 5.0 kit has proven to be a trustworthy tool for identifying the species of game meat. However, there may be some issues, as was the case with the analysis of elk, wild boar, and reindeer.

**Keywords:** game meat, jerky, authentication, DNA, species identification, LCD Array Kit MEAT 5.0

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**Contact address:** Ing. Adam Hanuska, Institute of Foods Sciences, Faculty of Biotechnology and Food Sciences, Slovak University of Agriculture in Nitra, Trieda Andreja Hlinku 2, 94976 Nitra, Slovakia; <u>xhanuska@uniag.sk</u> Ing. Ľubomír Belej, PhD., Institute of Foods Sciences, Faculty of Biotechnology and Food Sciences, Slovak University of Agriculture in Nitra, Trieda Andreja Hlinku 2, 94976 Nitra, Slovakia; <u>lubomir.belej@uniag.sk</u> doc. Ing. Miroslav Kročko, PhD., Institute of Foods Sciences, Faculty of Biotechnology and Food Sciences, Slovak University of Agriculture in Nitra, Trieda Andreja Hlinku 2, 94976 Nitra, Slovakia; <u>miroslav.krocko@uniag.sk</u>

### SECTION

Technology, quality and safety of raw materials and foodstuffs of plant origin

#### Dynamics of magnesium concentration in baobab leaves: Site-specific variation in Sudan

#### Abdelhakam Esmaeil Mohamed AHMED, Massimo MOZZON, Ayaz Mukarram SHAIKH, Elshafia ALI HAMID MOHAMMED, Béla KOVÁCS

#### Supervisor: Prof. Dr. Béla Kovács PhD.

Baobab trees Adansonia digitata L. have long been revered for their ability to thrive in arid and semi-arid environments, providing efficient resources for communities in these regions. Among the essential nutrients found in baobab leaves. Magnesium (Mg) plays a conclusive role in various physiological functions for humans. Its roles encompass assisting in muscle and nerve activity, maintaining blood pressure levels, and bolstering the immune system. This study explored the variations in Magnesium concentration in baobab leaves across three distinct sites: Mountain (M), Plain land (P), and Wetland (W) in Sudan, to highlight the possible nutritional importance of this extraordinary tree. Laboratory analyses were conducted at the Food Science Institute, University of Debrecen, Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES) was used to analyze Magnesium quantification. The analysis of variance (ANOVA) highlighted the significant (p<0.001) influence of distinct sites on Magnesium concentration. Notably, Plain land site exhibited the highest (529 mg/100 g), Magnesium content, followed by the mountain site (500 mg/100 g) and the lowest (471 mg/100 g) in the wetland site, respectively. The finding emphasizes the need to consider specific site factors when assessing the dynamic of Magnesium concentration in baobab leaves. Understanding these variations holds great potential for optimizing and offers significant opportunities for refining dietary recommendations and nutrient intake for individuals residing in those locations. Ultimately, this research contributes to a deeper appreciation of the environmental and nutritional significance of baobab trees in Sudan's diverse sites.

#### Keywords: Baobab leaves, Magnesium, Kordofan, Site, Nutritional

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**Contact address**: Abdelhakam Esmaeil Mohamed Ahmed (Ahmed A. E. M.), Ayaz Mukarram Shaikh, Béla Kovács, Faculty of Agricultural and Food Sciences and Environmental Management, Institute of Food Science, University of Debrecen, H-4032, Böszörményi str. 138, Debrecen, Hungary, <u>ahmed.abdelhakam@agr.unideb.hu</u>. Abdelhakam Esmaeil Mohamed Ahmed (Ahmed A. E. M.), Faculty of Forestry, University of Khartoum, Postal Code 13314, Khartoum North, Sudan. Massimo Mozzon, Department of Agricultural, Food and Environmental Sciences, Università Politecnica delle Marche, Via Brecce Bianche 10, 60131 Ancona, Italy, <u>m.mozzon@staff.univpm.it</u>. Elshafia, Ali Hamid Mohammed University of Debrecen, Faculty of Agric., Food and Science and Environmental Management, Dept. of Animal Science, Debrecen, Böszörményi 138, Hungary, Agriculture Research Corporation (ARC), Edamer, Sudan, <u>elshafia@agr.unideb.hu</u>.

#### Total polyphenol content and antioxidant activity of selected Allium species

#### Natália ČERYOVÁ, Judita LIDIKOVÁ, Marek ŠNIRC, Monika ŇORBOVÁ, Silvia FEDORKOVÁ

Supervisor: prof. Ing. Judita Lidiková, PhD.

In recent years, the demand for high-quality and healthy foods containing valuable substances that can prevent various diseases has been growing significantly in the world. *Allium* vegetables are worth noting especially as a source of antioxidants and anticarcinogens, as well as antibiotic compounds. They are a valuable source of polyphenolic compounds and biologically active phytomolecules, especially flavonols and phenolic acids, as well as many other substances that have a beneficial effect on the human body.

White onion (*Allium cepa* L.), red onion (*Allium cepa* L.), garlic (*Allium sativum* L.), leek (*Allium porrum* L.) and chives (*Allium schoenoprasum* L.) from different localities (Sabinov, Štvrtok na Ostrove, Hliník and Hronom, Oravská Lesná) were analysed in the presented study. Total polyphenol content (TPC) was determined by Folin-Ciocalteau method using the UV-VIS spectrophotometry. Antioxidant activity (AA) was determined by ABTS method using the UV-VIS spectrophotometry.

TPC in white onion ranged from 214.3 to 321.5 mg GAE.kg<sup>-1</sup> fresh weight (FW), in red onion from 1258 to 1525 mg GAE.kg<sup>-1</sup> FW, in garlic from 485.7 to 685.8 mg GAE.kg<sup>-1</sup> FW, in leek from 239 to 498.5 mg GAE.kg<sup>-1</sup> FW, and in chives from 1258 to 1428 mg GAE.kg<sup>-1</sup> FW. Statistically significant differences (P < 0.05) in the TPC were confirmed between white onion and red onion, white onion and garlic, white onion and chives, red onion and garlic, red onion and leek or leek and chives. There was not observed any significant effect of locality on TPC. AA in white onion ranged from 0.55 to 0.65 mmol Trolox.kg<sup>-1</sup> FW, in red onion from 3.85 to 4.49 mmol Trolox.kg<sup>-1</sup> FW, in garlic from 0.97 to 1.49 mmol Trolox.kg<sup>-1</sup> FW, in leek from 1.09 to 1.2 mmol Trolox.kg<sup>-1</sup> FW, and in chives from 4.69 to 4.15 mmol Trolox.kg<sup>-1</sup> FW. Statistically significant differences (P < 0.05) in the AA were confirmed among white onion and all other species, between red onion and garlic, red onion and leek or leek and chives. There was not observed any significant effect of locality on AA. Positive correlation was observed between TPC and AA of *Allium* samples (R = 0.97,  $\alpha$  = 0.05).

#### Keywords: Allium; total polyphenol content, antioxidant activity

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**Contact address**: Natália Čeryová, Institute of Food Sciences, Faculty of Biotechnology and Food Sciences, Slovak University of Agriculture in Nitra, Tr. A. Hlinku 2, 949 76, Nitra, Slovak Republic, xceryova@uniag.sk

### Effect of heat treatments on total polyphenol content and antioxidant activity of sweet chestnuts (*Castanea sativa* Mill.)

#### Silvia FEDORKOVÁ, Janette MUSILOVÁ, Marek ŠNIRC, Monika ŇORBOVÁ, Natália ČERYOVÁ

Supervisor: prof. Ing. Janette Musilová, PhD.

Sweet chestnuts (*Castanea sativa* Mill.) are an important food in many countries. At present, consumers are increasingly interested in chestnuts for their nutritional properties and potential health benefits. They contain high amounts of health-promoting compounds, including the antioxidants L-ascorbic acid, vitamin E, and polyphenols. This study aims to evaluate the effects of heat treatment (boiling – 30 min./100 °C, baking – 20 min./180 °C, microwaving – 2 min./800 W, and steaming - 30 min./100 °C) on the total polyphenol content and antioxidant activity of sweet chestnuts from five Slovakian growing areas using the UV-VIS spectrophotometry methods. The total polyphenol content (TPC) was determined using the Folin-Ciocalteu reagent. TPC values ranged from 0.726 to 5.443 (raw flesh), 0.917 to 1.996 (boiled samples), 1.023 to 2.745 (baked samples), 1.346 to 14.663 (microwaved samples), and 1.022 to 3.078 (steamed samples) (mg GAE/g FW (fresh weight)). The antioxidant activity (AA) was determined by the method of DPPH radical scavenging activity. AA values ranged from 2.151 to 2.456 (raw flesh), 2.166 to 2.524 (boiled samples), 2.222 to 2.538 (baked samples), 2.228 to 2.575 (microwaved samples), and 2.39 to 2.516 (steamed samples) (µmol TE/g FW). Statistical differences were observed in TPC between microwaved samples and baked, boiled samples. The examined parameters (TPC, DPPH AA) were correlated according to Spearman's coefficient (0.4406). Among the used methods, microwaving had the greatest impact on total polyphenol content and antioxidant activity. Individual heat treatments affect the chemical composition of chestnuts and the content of biologically valuable substances. For these reasons, other analyses that increase knowledge of the chemical composition of differently processed chestnuts are desirable.

Keywords: sweet chestnuts, antioxidant activity, polyphenols, heat treatments

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**Contact address:** Silvia Fedorková, Slovak University of Agriculture, Institute of Food Science, Trieda A. Hlinku 2, 949 76 Nitra, Slovakia, xfedorkovas@uniag.sk

#### Effect of red wine grape processing on content of phenolic compounds in rosé wines

Martin JANÁS, Alex TOMÁŠKO, Štefan AILER

Supervisor: Doc. Ing. Štefan Ailer, PhD.

In the experiment, we investigated the influence of the method of grape harvesting and the addition of wine clarifying agents on the content of phenolic compounds in rosé wine. For wine production, we used grapes from manual and mechanical harvesting. The biological material was grapes of the variety 'Lemberger' from the Topol'čianky wine-growing village, which is part of the Nitra wine-growing region. We harvested and processed the grapes on 22.10.2022. After obtaining the must, we used calcium bentonite for desilting. We injected a pure culture of wine yeast into the desilted must. After fermentation, we added clarifying agents to the produced rosé wine. We divided the experiment into 4 variants with 3 replications, namely 2 variants with manual harvesting and 2 variants with mechanical harvesting. Within both harvesting method variants, we created variants: 1. with only bentonite addition (100 g/hL) and 2. with bentonite (100 g/hL) and polyvinylpolypyrrolidone (15 g/hL) addition. We used Fourier transform infrared spectrometry to determine the basic physicochemical parameters of the musts and wines. We determined total phenolic content by the Folin-Ciocalteu method. We verified data distribution by the Shapiro-Wilk test. We examined variance by one-way ANOVA and Tukey's post hoc test (least significant difference test, P < 0.05). From the physicochemical parameters of the must, we monitored the content of sugars and acids in the musts of the different variants. The differences in the content of total sugars and total acids in the must between manual and mechanical harvesting were not statistically significant. We found a higher malic acid content in musts produced from mechanical grape harvesting compared to manual harvesting. The malic acid content of the must was 3.65 g/L for mechanical harvesting and 3.51 g/L for manual harvesting. We found a higher total phenolic content in the wine obtained from mechanically harvested grapes compared to manually harvested grapes. In the wine from manual grape harvesting, we found the content of phenolic compounds in the wine ranged from 268.89 to 285.56 mg GAE/L. In the wine from mechanical grape harvesting, we found a total phenolic content ranging from 321.11 to 348.15 mg GAE/L. After the addition of polyvinylpolypyrrolidone, we observed a decrease in the content of total phenolics in both manual (-3.90 %) and mechanical (-7.00 %) harvesting variants. The differences after polyvinylpolypyrrolidone addition were statistically significant compared to the variant with only bentonite addition. The lower phenolic content leads to a reduction of oxidative processes in the wine and increases its archiving potential. We confirmed the effect of the clarifying agent polyvinylpolypyrrolidone on the reduction of wine phenolic substances.

**Keywords:** rosé wine, manual harvesting, mechanical harvesting, phenolic compounds, bentonite, polyvinylpolypyrrolidone, Blaufränkisch

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**Contact address:** Slovak University of Agriculture in Nitra, Faculty of Horticulture and Landscape Engineering, Department of Horticulture, Tr. A. Hlinku 2, 949 76 Nitra, Slovak Republic; Martin Janás, <u>xjanas@uniag.sk</u>; Alex Tomáško, <u>xtomasko@uniag.sk</u>; Štefan Ailer, <u>stefan.ailer@uniag.sk</u>

#### The current situation of the use of brewers' spent grain

Vivien NAGY, Endre MÁTHÉ, Gerda DIÓSI

#### Supervisor: Dr.Gerda Diósi, Ph.D.

The history of brewing beer dates back to antiquity. It is recorded that beer was a favourite drink of the Sumerians. A valuable by-product (accounting for nearly 85% of all food waste in the brewing industry) is the brewers' spent grain (BSG), which is a by-product - in many cases waste - from the brewing process. BSG is a nutrient-rich unused food by-product. It can serve as a new and excellent source of fibre for the ever-evolving food industry and nutrition science. In the present study, the current situation of the use of BSG was investigated using a questionnaire method. Two questionnaires were compiled, asking about the nationality of the respondents, their use of BSG after brewing (if any), and whether they had researched the possible uses of brewers' spent grain. One question asked whether they would be willing to change the recipe used in brewing to obtain a more valuable by-product. Respondents were asked what would motivate them if they had the opportunity to focus on by-products. The questionnaire focused on professionals who are involved in brewing at an academic or industrial level, or who are home brewers. The first questionnaire was completed by 71 people and the second by 34 people from all over the world, including the USA, India, Nepal, Slovakia, Hungary, etc. 90% of respondents to the first questionnaire were male, while 85% of respondents to the second questionnaire were male. 22% of respondents do not recycle their BSG in any way, it becomes waste. 32% of respondents said yes, 41% might change the recipe used in the brewing process if the use of BSG required it. In the course of our research, we would like to draw attention to the importance of the knowledge of beer industry by-products primarily BSG, since at present, the knowledge of BSG and the investigation of its food industry utilization are not among the priorities. It is hoped that the results of our research will raise awareness of the importance of the utilisation of by-products and the feasibility of a circular economy.

#### Keywords: brewers' spent grain, by-product, beer, recovery, questionnaire

**Contact address:** Vivien Nagy, University of Debrecen, Faculty of Agricultural and Food Sciences and Environmental Management, Institute of Food Technology, 138 Böszörményi Street Debrecen, Hungary, <a href="mailto:nagy.vivien@agr.unideb.hu">nagy.vivien@agr.unideb.hu</a>

### Antioxidant activity, total polyphenols, and content of minerals in medlar fruit (Mespilus germanica L.)

Monika ŇORBOVÁ, Alena VOLLMANNOVÁ, Ľuboš HARANGOZO, Marek ŠNIRC, Silvia FEDORKOVÁ, Natália ČERYOVÁ

Supervisor: prof. RNDr. Alena VOLLMANNOVÁ, PhD.

Mespilus germanica L. is a perennial plant with firm fruits that are harvested in autumn or winter after frost and kept in cool and dark places. The medlar is a significant fruit with many beneficial health-related traits. All parts of the medlar tree are used in traditional medicine. Medlar fruits are used to prepare jam, jelly, syrup, candied fruit, and spices to produce fruit wine. This fruit is rich in various sugars, organic acids, amino acids, polyphenols, and other nutrients, minerals, and trace elements. It is also a very rich source of bioactive compounds and natural antioxidants and has the potential to be used in food and nutritional supplements. This work aims to determine the total content of polyphenols, and the total antioxidant activity and to determine the content of macro and micro elements to find out how important the medlar fruit is in terms of nutrition. The total content of polyphenols in medlar fruits from three different locations (Piešťany, Nitra, Switzerland) ranged from 834.26 mg GAE.g<sup>-1</sup> (Nitra) to 943.37 mg GAE.g<sup>-1</sup> (Switzerland). The values of antioxidant activity by the DPPH method were from 1.79 µmol TE.g<sup>-1</sup> DW (Piešťany) to 2.28 µmol TE.g<sup>-1</sup> DW (Switzerland). Samples from Switzerland showed the highest antioxidant activity determined by the FRAP method (5.03 umol TE.g<sup>-1</sup> DW). The antioxidant activity of ABTS showed the lowest values (0.09 - 0.11)µmol TE.g<sup>-1</sup> DW) among all investigated methods. Medlar fruits are also a rich source of macroelements (K, Na, Ca, Mg, P). The Ca:P ratio in the samples was 0.93 (Switzerland), 0.96 (Piešťany), and 1.03 (Nitra). This ratio should not be less than 1. The potassium content was the highest among the detected macroelements  $(6138.9 - 7371.3 \,\mu g.g^{-1})$ , and the sodium content was the lowest among these elements  $(20.40 - 33.60 \ \mu g.g^{-1})$ . For adequate nutrition, the ratio of the mineral components (Na:K) is important. In the samples, the ratio of Na:K was as follows: 0.005 (Piešťany, Nitra) and 0.003 (Switzerland). Of the microelements, copper was the most abundant  $(3.6 - 6.3 \mu g.g^{-1})$ . The content of risk elements (Cd, Pb, Hg) was below the limit of detection. Spearman's correlation test shows a positive correlation between TPC and ABTS (p=0.59) and also between the values of the antioxidant activities of DPPH and FRAP (p=0.92). The Kruskal-Wallis test (Dunn's comparison) showed a statistically significant difference between the samples in the antioxidant activity of ABTS (p=0.02). The Kruskal-Wallis test showed a statistically significant difference in the content of microelements Cu, Zn, Mn, and Ni (p < 0.001). There is no statistically significant difference in the content of macroelements.

#### Keywords: medlar, antioxidant activity, polyphenols, minerals

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**Contact address:** Monika Ňorbová, Slovak University of Agriculture, Institute of Food Science, Trieda A. Hlinku 2, 949 76 Nitra, Slovakia, xnorbova@uniag.sk

#### "The impact of AI on food science research: A critical review"

#### Ayaz Mukarram SHAIKH<sup>1</sup>, Abdelhakam Esmaeil Mohamed AHMED<sup>1,2</sup>, Elshafia ALI HAMID MOHAMMED<sup>3,4</sup>, József PROKISCH<sup>5</sup>, Béla KOVACS<sup>1</sup>

#### Supervisor: Prof. Dr. Béla Kovács PhD.

In the dynamic realm of food science and technology, a seismic shift is underway, driven by the convergence of artificial intelligence (AI) and traditional research methodologies. This abstract aims to make a compelling case for the integration of AI technologies in the landscape of PhD research in this field. Food science demands in-depth inquiries into crucial aspects such as food safety, quality assessment, nutritional analysis, and product innovation. As these research domains grow increasingly complex, PhD students grapple with the formidable task of navigating vast datasets, conducting intricate experiments, and deriving meaningful conclusions. AI-powered tools present a promising solution, offering students the potential to significantly enhance their research endeavors.

This abstract explores the manifold ways in which artificial intelligence can expedite data processing, automate experiments, fine-tune process parameters, and facilitate predictive modeling. AI-driven algorithms have the potential to unearth emerging trends, streamline literature reviews, and offer invaluable insights into experimental design. These technologies empower researchers to redirect their energies toward the creative aspects of their work, while simultaneously streamlining the laborious data processing tasks. Real-world examples and case studies provide tangible evidence of the concrete benefits of integrating AI technologies into food science and technology research.

Furthermore, the adoption of AI tools effectively bridges the gap between traditional food science and cutting-edge technology, enabling students to harness the power of machine learning, data analytics, and automation. This synthesis underscores the vital importance of multidisciplinary collaboration. Machine Learning Algorithms and Fundamentals as Emerging Safety Tools can be used in preservation of fruits and Vegetables.

In conclusion, the incorporation of AI tools into food science PhD research holds the potential to revolutionize how students approach their work, improving accessibility and productivity, and advancing knowledge in this critical field. Nonetheless, it is essential to recognize that specific scientific results are needed to fully validate the impact of AI technologies in this domain. Future research should focus on these outcomes.

# **Keywords**: Artificial Intelligence (AI), Food Science and Technology, Machine learning, Technology integration etc.

#### References-

Pandey, V.K.; Srivastava, S.; Dash, K.K.; Singh, R.; Mukarram, S.A.; Kovács, B.; Harsányi, E. Machine Learning Algorithms and Fundamentals as Emerging Safety Tools in Preservation of Fruits and Vegetables: A Review. Processes 2023, 11, 1720. https://doi.org/10.3390/pr11061720

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Contact address: <sup>1</sup>Faculty of Agricultural and Food Sciences and Environmental Management, Institute of Food Science, University of Debrecen, H-4032, Böszörményi str. 138, Debrecen, Hungary, Email: Ayaz.shaikh@agr.unideb.hu; Kovacsb@agr.unideb.hu; Ahmed.abdelhakam@agr.unideb.hu

<sup>2</sup>Faculty of Forestry, University of Khartoum, Postal Code 13314, Khartoum North, Sudan.

<sup>3</sup>Faculty of Agriculture, Food Science and Environmental Management, Department of Animal Science, Debrecen, Böszörményi 138, Hungary,

<sup>4</sup>Agriculture Research Corporation, Edamer, Sudan, Email: <u>elshafia@agr.unideb.hu</u>

<sup>5</sup>Institute of Animal Science, Biotechnology and Nature Conservation, Faculty of Agricultural and Food Sciences and Environmental Management, University of Debrecen, Böszörményi út 138, 4032 Debrecen, Hungary, Debrecen, Hungary.

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