SCIENTIFIC CONFERENCE OF PHD STUDENTS

SLOVAK UNIVERSITY OF AGRICULTURE IN NITRA

INTERNATIONAL SCIENTIFIC CONFERENCE

14 NOV 2024

NITRA SLOVAK REPUBLIC

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

DOI: https://doi.org/10.15414/2025.9788055228310

SLOVAK UNIVERSITY OF AGRICULTURE IN NITRA

SUA·FAFR Faculty of Agrobiology and Food Resources

SUA·FBFS Faculty of Biotechnology and Food Science

SUA·FHLE Faculty of Horticulture and Landscape Engineering

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

-

Book of abstracts

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

14th November 2024
Nitra, Slovak Republic

DOI: https://doi.org/10.15414/2025.9788055228310

Scientific Conference of PhD Students of FAFR, FBFS and FHLE SUA in Nitra – Book of abstracts

Scientific guarantors
prof. PaedDr. Ing. Jana Žiarovská, PhD.
doc. Ing. Ján Horák, PhD.
doc. Ing. Miroslav Kročko, PhD.

Scientific committee
doc. Ing. Simona Kunová, PhD.
doc. Ing. Katarína Miklášová, PhD.
Ing. Alžbeta Demianová, PhD.
doc. Ing. Ľuba Ďurišová, PhD.
Ing. Marek Rašovský, PhD.
Ing. Dávid Ernst, Ing.Paed.IGIP, PhD.
doc. Mgr. Peter Juhás, PhD.
doc. Ing. Michal Rolinec, PhD.
doc. Ing. Jaroslav Andreji, PhD. doc.
Ing. Beáta Novotná, PhD.
doc. Ing. Ján Kollár, PhD.
Ing. Miroslav Čibik, PhD.
Ing. Mária Tárníková, PhD.
prof. Ing. Katarína Ražná, PhD.
doc. Ing. Milan Chňapek, PhD.
Ing. Alica Navrátilová, PhD.

Organizing committee
Ing. Veronika Štefúnová, PhD.
doc. Ing. Martina Fikselová, PhD.
Ing. Andrea Matuškovičová
Mgr. Dominik Hollý
Ing. Katarina Poláková
Ing. Denis Bažány
Ing. Adam Hanuska
Ing. Ema Balková
Ing. Simona Čerteková
Ing. Ivan Ravza
Ing. Laura Hačková
Ing. Melinda Molnárová
Ing. Zuzana Vinczeová
Ing. Adrián Selnekovič

Reviewers:
Ing. Justína Vitková, PhD. - Institute of Hydrology of the Slovak Academy of Sciences
doc. RNDr. Tünde Juríková, PhD. - Constantine of Philosopher University in Nitra
doc. Ing. Šárka Nedomová, PhD. - Mendel University in Brno

Approved by the rector of the Slovak University of Agriculture in Nitra
as an online book of reviewed abstracts on January 31st, 2025.

This work is published under the license of the Creative Commons Attribution-NonCommercial 4.0 International Public License (CC BY-NC-ND 4.0).
https://creativecommons.org/licenses/by-nc-nd/4.0

ISBN 978-80-552-2831-0

DOI: https://doi.org/10.15414/2025.9788055228310

Content

DOI: https://doi.org/10.15414/2025.9788055228310

DOI: https://doi.org/10.15414/2025.9788055228310

DOI: https://doi.org/10.15414/2025.9788055228310

DOI: https://doi.org/10.15414/2025.9788055228310

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

DOI: https://doi.org/10.15414/2025.9788055228310

SECTION

Technology, Quality and Safety of Raw Materials and Foodstuffs

DOI: https://doi.org/10.15414/2025.9788055228310

Effect of Enzyme: Substrate Ratio on the Bioconversion of Milk Protein Concentrate: A Comparative Study of Trypsin and protease from Streptomyces griseus type XIV (PSG)

Firas ALARAWI

Supervisors: Prof. Quang D. Nguyen and Dr. Olivia Csernus

Enzymatic hydrolysis of milk protein concentrate (MPC) produces bioactive peptides with potential antioxidant activities. This study investigates the effect of varying concentrations of Trypsin and protease from *Streptomyces griseus* type XIV (PSG) on the hydrolysis of MPC, focusing on the extent of bioconversion and resulting antioxidant activities. MPC was hydrolysed using Trypsin and PSG at four different concentrations (13.8, 27.7, 41.6, and 55.5 µg/ml). The degree of hydrolysis was assessed via SDS-PAGE. Samples were prepared by diluting lyophilized hydrolysates with a sample buffer to a concentration of 5 mg/ml, followed by heating at 95°C for 5 minutes. Electrophoresis was conducted at 200V for 60 minutes. The antioxidant activity of the resulting peptides was determined using the DPPH radical scavenging method, with measurements taken spectrophotometrically at 517 nm. Gel electrophoresis revealed that higher concentrations of Trypsin and PSG resulted in more extensive hydrolysis, indicated by lower molecular weight bands. Antioxidant assays demonstrated a positive correlation between enzyme concentration and antioxidant activity, with PSG-treated MPC exhibiting superior antioxidant properties compared to Trypsin-treated MPC. Control samples treated with buffer and water showed some antioxidant activity, attributed to protein bond cleavage during boiling, but significantly lower than enzymatically hydrolysed samples. The findings highlight that increasing enzyme concentration enhances MPC hydrolysis, producing smaller peptide fragments with higher antioxidant activity. PSG outperformed Trypsin in generating peptides with superior antioxidant properties. These results align with established enzyme kinetics principles and support the potential of PSG in producing functional food ingredients with enhanced health benefits.

Key words: *Milk Protein Concentrate (MPC), Enzymatic Hydrolysis, Trypsin, protease from Streptomyces griseus type XIV (PSG), Antioxidant Activity, DPPH Radical Scavenging.*

Acknowledgement: The research was supported by GINOP_PLUSZ-2.1.1-21-2022-00048, EFOP-3.6.3-VEKOP-16-2017-00005, and TKP2021 projects.

Contact address: Department of Bioengineering and Alcoholic Drink Technology, Institute of Food Science and Technology, the Hungarian University of Agriculture and Life Sciences, H-1118 Budapest, Ménesi út 45, Hungary. Second Faculty of Agriculture, Damascus University, Damascus, Syria. E-mail: firas.alarawi.94@gmail.com.

Chestnut shells (*Castanea sativa* Mill.): A rich source of antioxidants, polyphenols, and mineral substances

Silvia FEDORKOVÁ, Janette MUSILOVÁ, Monika CIFROVÁ, Ľuboš HARANGOZO

Supervisor: prof. Ing. Janette Musilová, PhD.

Sweet chestnut (*Castanea sativa* Mill.) is an important tree in many European countries. The nutritionally rich nuts of this tree are especially valued. Not only sweet chestnut nuts have high potential, but also leaves, flowers, shells, wood, and bark. Chestnut shells, which are produced as a by-product during processing, are an important source of many nutrients (tannins, phenolic acids, polyphenols, flavonoids, and vitamin E. The aim of this work was to analyse the shells of sweet chestnuts from various locations in Slovakia (Svätý Jur, Doľany, Jelenec, Lefantovce, Závada, Močenok, Mlyňany, Modrý Kameň, Krná, and Rovňany) to find out how important sweet chestnut shells are in terms of reuse. The total content of polyphenols (TPC) and antioxidant activity (DPPH, FRAP, ABTS methods) were determined using UV-VIS spectrophotometric methods. The contents of mineral substances (K, Ca, P, Mg, and Fe) were determined on a VARIAN AA 240FS after their mineralisation (Mars X-Press 5); phosphorus on a Shimadzu UV-1800 spectrophotometer. The total polyphenol content was determined using the Folin–Ciocalteu reagent. TPC values ranged from 6.165 (Modrý Kameň) to 27.940 (Rovňany) mg GAE/g DW (dry weight). The antioxidant activity ranged from 3.438 to 4.579 µmol TE/g DW (DPPH), 0.083 to 0.237 µmol TE/g DW (ABTS), and 70.425 to 544.504 µmol TE/g DW (FRAP). The highest antioxidant activity by all methods was determined in the sample from the Rovňany location, as well as in the determination of TPC. The content of five mineral substances determined in chestnut shells from ten studied localities ranges from 6,383.8 to 893.1 mg K/kg DW, 516.2 to 3,876.3 mg Ca/kg DW, 763.3 to 1,747.3 mg Mg/kg DW, 343.8 to 1,363.5 mg P/kg DW, and 10.7 to 34.9 mg Fe/kg DW. The Močenok location has the lowest K and Fe content, followed by the Modrý Kameň location for Mg and P, and the Mlyňany for Ca. Shells from Močenok had the highest levels of Ca and Mg, while Modrý Kameň had the highest content of Fe. One of the elements that dominates in chestnuts and their shells is potassium. Its concentration was the greatest in the Mlyňany location. Consequently, the results indicate a significant potential for repurposing the waste from the production of chestnut shells. This kind of waste may be used as a natural antioxidant source, depending on its amount of phenolics. Reusing these unused shells could present new challenges for industries such as food, cosmetics, pharmaceuticals, and others that create high-value products.

Key words: *sweet chestnut shells, antioxidant activity, polyphenols, mineral substances*

Acknowledgement: Work was supported by grant APVV-22-0255.

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

DOI: https://doi.org/10.15414/2025.9788055228310

Sea buckthorn pomace as a new source of natural antioxidant in meat industry

Andrea MESÁROŠOVÁ, Marek BOBKO, Lukáš JURČAGA, Alica BOBKOVÁ, Alžbeta DEMIANOVÁ, Katarína POLÁKOVÁ, Terézia ŠVECOVÁ

Supervisor: doc. Ing. Marek Bobko, PhD.

The greatest value of sea buckthorn (*Hippophae rhamnoides*) is typically linked to its high antioxidant content. In addition, a wide variety of different positive biological, physiological and medicinal effects of sea buckthorn have been widely described. Sea buckthorn pomace is a valuable industrial waste/co-product obtained after juice production that contains bioactive, health-promoting dietary fibers. This pomace finds usage as animal feed or simply discarded, owed to the lack of appropriate handling or processing facilities. The berries, leaves and bark are rich in many bioactive substances valuable for nutritional and health-promoting properties. The fruits are rich in carotenoids, tocopherols, tocotrienols, essential polyunsaturated fatty acids, which are known to have significant antibacterial, antiatherogenic and cardioprotective effects. Sea buckthorn leaves are also rich in nutrients, macro- and microelements. Sea buckthorn seeds mainly contain oleic acid, palmitic acid and linoleic acid. The acidity of the fruit can be attributed to the high content of vitamin C. The main goal of the study was to determine the effect of sea buckthorn co-products on the oxidative stability of raw cooked meat products, as well as to determine the antioxidant capacity and the total polyphenols content in sea buckthorn co-product. The total polyphenol content (TPC) was determined using the Folin-Ciocalteu reagent method. TPC in sea buckthorn co-product was 67.73 g GAE/kg. The total antioxidant capacity was measured by the method of DPPH radical scavenging activity (TAC). TAC in sea buckthorn co-product was at the level of 97.4%. The oxidative stability of the raw-cooked product was based on measurements of the malondialdehyde (MDA) concentration by thiobarbiturate test using a 2-thiobarbituric acid (TBA) solution. Four groups of pork sausages were prepared. A control group (Con) without the addition of an antioxidant, a control group with the addition of ascorbic acid 0.5 g/kg (ConC), a group with the addition of sea buckthorn pomace extract 5 mL/kg (SBe), and a group with the addition of sea buckthorn pomace powder 5 g/kg (SBp). The addition of sea buckthorn pomace powder (SBp) was able to inhibit the formation of MDA at the level of 24%, which is comparable to the control group with the addition of ascorbic acid (ConC), which was able to inhibit MDA by up to 30%. In our work, we proved that sea buckthorn co-product has great potential as an antioxidant for the meat industry. In various forms, it can potentially delay lipid oxidation processes. However, more research is needed to prove it conclusively.

Key words: *sausages, co-product, natural antioxidant, oxidation, sea buckthorn*

Acknowledgement: This work was supported by the Slovak Research and Development Agency under grant KEGA 001 SPU — 4/2023.

Contact address: Andrea Mesárošová, Slovak University of Agriculture in Nitra, Faculty of Biotechnology and Food Science, Institute of Food Science, Tr. A. Hlinku 2, 94976 Nitra, e-mail: xmesarosova@uniag.sk

Antifungal activity of essential oils used in vapour phase, synergistic combinations, and encapsulated form against *Penicillium* spp.

Monika MRVOVÁ, Arkadiusz ZAKRZEWSKI

Supervisor: prof. Ing. Dana Tančinová, PhD.

Plant essential oils (EOs) are natural extracts known for their broad-spectrum biological activities. This study aimed to evaluate the antifungal efficacy of selected EOs through a multi-step selection process, assessing their effects in three forms: individually in free volatile form, in combination, and in encapsulated form. The primary objective was to enhance EO activity through combinations and to explore encapsulation as a method for stabilizing and controlling EO release. EO and fungal strain selection were guided by results from prior experiments. In the first phase of the study, EOs from the Lamiaceae family were evaluated *in vitro* against *Penicillium expansum* and *Penicillium olsonii* using the vapor diffusion method. The EOs were tested at a concentration of 625 $\mu L.L^{-1}$ over a 14-day incubation period. A 5-µL spore suspension from a 7-day-old *Penicillium* culture was inoculated onto the medium, and a filter paper placed on the lid of a petri dish was treated with 40 µL of the EO. The cultivation was carried out at 25 ± 1 °C. For EOs that demonstrated 100% inhibition of fungal growth, the minimum inhibitory concentration (MIC) was determined by serial dilution from 500 to 15.625 $\mu L.L^{-1}$. MIC values were evaluated by probit analysis (R study) for the resulting IC90 and IC50. Bergamot mint EO partially inhibited *P. expansum* at 625 $\mu L.L^{-1}$, lavender EO was completely effective at a given concentration but ineffective at 500 $\mu l.L^{-1}$. For spearmint EO, IC90 ranged from 296.11 to 606.83 $\mu L.L^{-1}$, and IC50 ranged from 260.87 to 524.96 $\mu L.L^{-1}$. To enhance the antifungal activity of lavender EO (potential antifungal effect), it was combined with spearmint EO (proven antifungal effect) in ratios of 50:50, 25:75, and 75:25. The best results were obtained with 75% spearmint and 25% lavender, showing an IC90 of 312.43 $\mu L.L^{-1}$. Synergistic effects nearly doubled lavender's potency, while spearmint's efficacy improved slightly from IC90 376.88 to 312.43 $\mu L.L^{-1}$. The antifungal activity of mint EOs was also assessed against *P. olsonii*, alongside thyme EO. At 625 $\mu L.L^{-1}$, only thyme EO achieved 100% inhibition, while bergamot and spearmint EOs showed reduced efficacy, with 86.32% (2 strains) and 85.53% (1 strain) inhibition, respectively. MIC for thyme EO was determined at 250 $\mu L.L^{-1}$, with IC50 ranging from 31,25 to 79.54 $\mu L.L^{-1}$ and IC90 from 35.72 to 162.27 $\mu L.L^{-1}$. Thyme EO was tested for the application by freeze-drying encapsulation. Samples were obtained using a Cryolizer Freeze Dryer type B-64 (New Brunswick Scientific Co., Inc., Edison, NJ, USA). Powdered samples, equivalent to 40 µL, were applied either to filter paper placed in the lids of petri dishes or directly onto the culture medium. The encapsulated thyme EO exhibited 100% antifungal efficacy, with no colony growth observed.

Key words*: essential oils, antifungal activity, Penicillium, synergistic activity, encapsulation*

Acknowledgement: This research was supported by project VEGA 1/0517/21.

Contact address: Monika Mrvová, Institute of biotechnology, Faculty of biotechnology and food sciences, Slovak university of agriculture in Nitra, Tr. A Hlinku 2, 949 76 Nitra, Slovakia, xmrvova@uniag.sk

DOI: https://doi.org/10.15414/2025.9788055228310

Evaluation of grape yield and must quality from grapevines expressing symptoms of grapevine trunk diseases in the 2024 vintage from the Nitra wine-growing district

Martin JANÁS, Štefan AILER, Adrián SELNEKOVIČ, Jakub MANKOVECKÝ

Supervisor: Štefan Ailer

Grapevine trunk diseases (GTDs) are currently one of the most dangerous grapevine diseases. The aim of the experiment was to compare selected quantitative parameters of grapes and qualitative parameters of must produced from grapes from symptomatic and asymptomatic grapevines. In the experiment, we used grapes of the white wine variety Riesling Italico (RI) and red wine variety Cabernet Sauvignon (CS) from the Demonstration garden of the SUA in Nitra. In the control variants we used grapes from grapevines without foliar symptoms of GTDs. In the experimental variants, we used grapes from grapevines showing symptoms of chronic form of GTDs. We harvested a grape by hand on 20.9.2024. For quantitative parameters, we measured the average cluster weight and yield per vine using laboratory scales. We processed grapes from symptomatic and asymptomatic grapevines into must. We used the FT-IR spectroscopy method to analyse physicochemical parameters of must. To test the statistical significance of the results, we used the LSD test ($P \leq 0.05$). In symptomatic grapevines of CS, we found an average cluster weight of 101.58 ± 6.05 g. It is 22.60 g lower weight compared to the control variant. In the case of the RI, we found an average cluster weight of 130.89 ± 28.17 g, which is a lower weight compared to the control by 13.77 g. The difference in cluster weight on symptomatic and asymptomatic vines of the CS variety was statistically significant. We found a statistically significant lower average yield per vine of CS symptomatic vines (-504.71 g) compared to the control. The difference between the average yield per vine of symptomatic (-17.11 g) and asymptomatic vines of RI was not statistically significant. We found statistically significant changes in several quality parameters in the must produced from grapes of symptomatic vines. In the must made from grapes from symptomatic CS grapes, we found a total sugar content of 177.88 ± 0.10 g/l, which is 36.77 g/l lower value than in the control. In the case of RI, we found 163.36 ± 0.50 g/l sugars in the must from the symptomatic grapes, a difference of 38.24 g/l compared to the control. The differences in total sugars were statistically significant. In the must from the grapes of symptomatic CS grapes, we found a total acid content of 7.20 ± 0.08 g/l, which is 1.54 g/l higher than in the control. The difference was statistically significant. In the case of RI, we found no statistically significant differences in acid content between musts from asymptomatic and symptomatic vines. The malic acid content was statistically significantly higher for grapes from symptomatic vines in both varieties. The hypothesis that GTDs negatively affect the grape and must was confirmed.

Key words: *grapevine trunk diseases, cluster weight, grape yield, must*

Contact address: Martin Janás, Institute of Horticulture, Faculty of Horticulture and Landscape Engineering, Slovak University of Agriculture in Nitra, Tr. A. Hlinku 2, 949 76 Nitra, Slovakia, xjanas@uniag.sk

DOI: https://doi.org/10.15414/2025.9788055228310

Effect of grapevine biostimulant Tecamin on parameters of grape and must from white wine variety Devín in Strekov wine-growing district

Adrián SELNEKOVIČ, Ján MEZEY, Martin JANÁS, Ivana KOLLÁROVÁ

Supervisor: doc. Ing. Ján Mezey, PhD.

The quality of the wine is largely determined by the parameters of the basic raw materials—grapes. To be profitable, wine production must maximize yield per hectare. We define biostimulants as a group of substances that have a positive effect on the plant, the result of which is the higher quality of raw materials and an increase in yield per hectare. In the work, we investigated the effect of the application of biostimulants of the brands Tecamin Max, Tecamin Flower, and Tecamin Brix on the planting of the white wine variety Devín in the wine-growing district of Strekov. A total of 3 variants were created and a control variant. In variant I were sprayed with all preparations, and variant II were sprayed with biostimulants Tecamin Flower and Tecamin Brix. Each preparation was used once. Tecamin Max were applied in the BBCH 15 phenophase (fifth leaf developed), Tecamin Flower were applied in the BBCH 57 phenophase (before flowering), and Tecamin Brix were used in the BBCH 75 phenophase (pea sized berries). The grapes were harvested on 9/24/2024. After harvesting, quantitative grape parameters (berry weight, berry size) and qualitative grape parameters (grape sugar content, total acids, malic acid content) were evaluated on the variants. Qualitative parameters were determined using FT-IR spectroscopy. Berry length was evaluated using a caliper and berry weight using a laboratory scale. To evaluate the statistical evidence of the results, were used the TUKEY test ($P \leq 0.05$). The weight of 30 berries was the highest for variant I - 44.35 ± 3.15 grams compared to the control variant 29.85 ± 2.38 grams (+49%). The measured difference was statistically significant. The longest length of 30 berries was measured at variant II, 40.16 ± 3.93 cm, compared to the control variant, 33.30 ± 2.54 cm (+21%). Qualitative parameters showed a higher sugar content in variant II – 19.51 ± 0,15 °Bx (+20%) compared to the control variant 16.30 ± 0,1 °Bx and a lower content of total acids in variant II – 11.90 ± 0,06 g/l (-11%) compared to the control variant 13.23 ± 0,14 g/l. To produce quality wine, quality and mature raw materials with a balanced acid content, particularly malic acid, are required. The lowest content of malic acid was measured in variant II: 6.57 ± 0.07 g/l (-17%) compared to the control variant: 7.70 ± 0.21 g/l. The results of the work confirmed the positive impact of the application of biostimulants compared to the control variant, confirmed the increased yield per hectare, and improved the quality parameters of the grapes. Biostimulants are used in viticulture to improve the quality of the grape harvest.

Key words*: biostimulant, grapevine, Devín, Strekov, sugar content*

Acknowledgement: Work was supported by Organix s.r.o..

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

DOI: https://doi.org/10.15414/2025.9788055228310

Potential of Portulaca oleracea varieties cultivated in the Slovak Republic for vegetable juice production

Ivana KOLLÁROVÁ, Ivana MEZEYOVÁ, Ján MEZEY, Ján FARKAŠ

Supervisor: doc. Ing. Ivana Mezeyová, PhD.

Portulaca oleracea (purslane) is found worldwide and is used both as a medicinal plant and a food source. Despite being considered invasive in Slovakia, it is cultivated in tropical regions for its high nutritional value, which includes vitamins, omega-3 fatty acids, polyphenols, vitamins A, C, and B, minerals, and alkaloids, all of which offer health benefits. Purslane thrives in extreme conditions such as high temperatures, saline soils, and drought, making it a resilient crop for future agriculture. It holds potential as a nutritional source due to its bioactive compounds, easy cultivation, and adaptability. This study focused on the cultivation of two varieties of purslane (commercially available summer purslane (Zomerpostelein) from the Netherlands, and wild purslane found growing naturally in the garden of the Institute of Horticulture in Nitra) in the climatic conditions of the Slovak Republic in 2024, with five harvests. Vitamin C content in fresh biomass was analysed using the titration method. Vegetable juice was prepared and analysed for juice yield, Brix value, and sensory analysis of total sugars, total acids, and pH using an ALPHA analyzer. Statistical analysis was performed using Statgraphics Centurion XVII (ANOVA and LSD test). The results of our study show that, on average, the Zomerpostelein variety has a significantly ($P < 0,001$) higher vitamin C content (20.23±0.42 mg/100g FW) compared to the wild purslane variety (13.99±0.02 mg/100g FW). The Brix values are very similar in both varieties (Z: 3.39±0.12 °Bx and W: 3.34±0.05 °Bx), as are the pH values (Z: 3.47±0.03 and W: 3.25±0.07). Both Zomerpostelein and wild purslane also have comparable total acid content, 10.17±0.76 g/L and 9.50±0.97 g/L, respectively, and similar total sugar content (Z: 44.74±0.96 g/L and W: 43.47±0.75 g/L). However, juice yield was significantly different ($P < 0,001$) between the two varieties, with Zomerpostelein producing a higher yield (62.21±7.59%) compared to the wild purslane (39.34±4.43%). In conclusion, the results suggest that both *P. oleracea* varieties can be successfully cultivated in the conditions of the Slovak Republic and have potential for use as functional food in vegetable juice production. The Zomerpostelein variety proved to be more suitable for this purpose due to its higher vitamin C content and higher juice yield.

Key words: *purslane, vitamin C, juice yield, total sugars, total acids*

Acknowledgement (bold, Times New Roman 10): Work was supported by KEGA, grant number KEGA 004SPU-4/2022, “Interactive Classroom for Horticulture study program in the Context of Innovation of the Current Student's Teaching Process”

Contact address: Ivana Kollárová, Institute of Horticulture, Slovak University of Agriculture, Trieda Andreja Hlinku 2, 949 76, Nitra, xkollarovai@uniag.sk

DOI: https://doi.org/10.15414/2025.9788055228310

Impact of housing systems for laying hens on microbial contamination of eggs

Daniela KMEŤOVÁ, Martin MELLEN

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

Eggs intended for consumption must possess both strong nutritional value and microbiological safety. To be marketable and appealing to consumers, eggs need to meet high-quality standards. Nowadays, consumers show a growing interest in animal products, particularly those produced with attention to animal welfare, resulting in a notable rise in the number of hens raised in alternative, cage-free farming systems. Microbiological contamination can affect the safety, shelf life, and overall quality of eggs. The eggshell microbiota may harbor pathogenic microorganisms, as well as those responsible for egg spoilage. Among various risk factors, egg consumption has been identified as a notable contributor to occasional cases of salmonellosis. Microorganisms can contaminate eggs at various stages of production, handling, preparation, and consumption. The goal of our research was to assess the microbiological quality of the internal contents of eggs produced by hens from different housing systems. We isolated and identified total bacteria, coliforms, and *Salmonella* spp. using mass spectrometry. Total bacterial counts were determined using Plate Count Agar incubated for 48 hours at 30 °C, coliforms on Violet Red Bile Lactose Agar incubated for 24 hours at 37 °C, and *Salmonella* spp. on Xylose Lysine Deoxycholate Agar incubated for 24 hours at 37 °C. The lowest total bacterial counts were observed in eggs from the cage rearing system, while the highest were found in the aviary rearing system. Microbial counts were evaluated on days 0 and 21. *Ralstonia pickettii* was the most commonly isolated species across all samples. Our findings did not reveal the presence of *Salmonella* spp. or coliforms. The bacterial contamination levels in the egg contents were influenced by the housing system, as well as by storage temperature and duration. We observed that a higher number of eggs were contaminated at the start of the experiment, and at this stage, the isolated microorganisms made up a larger proportion of the overall species identified.

Key words: *microbiological, microorganisms, bacteria, microbiota, housing system*

Contact address: PaedDr. Daniela Kmeťová, MBA, Institute of Animal Husbandry, Faculty of Agrobiology and Food Resources, Slovak University of Agriculture in Nitra, Tr. A. Hlinku 2, 949 76, Nitra, Slovakia, e-mail: d.kmetova@vandenbergen.biz

DOI: https://doi.org/10.15414/2025.9788055228310

Effect of the addition of blackberry (*Rubus fruticosus*) on the microbiological quality of yoghurt

Adam HANUSKA, Miroslav KROČKO, Daniela ČECHOVÁ, Viera DUCKOVÁ

Supervisor: doc. Ing. Miroslav Kročko, PhD.

There is a growing consumer preference for foods in which synthetic chemical additives are replaced by natural substances. Adding plant extracts rich in polyphenols can enhance antioxidant capacity, helping preserve the sensory qualities of food. Besides their antioxidant properties, polyphenols exhibit various biological activities such as anticancer, anti-inflammatory, and antimicrobial effects. This study aimed to examine the impact of different concentrations of blackberry (*Rubus fruticosus*) extract on the microbiological quality of yoghurt. Blackberry pomace extract was prepared following the method of Shirahigue et al. (2010). Four groups of "set-type" yogurts were produced (one control and three experimental groups with 0.5%, 0.75%, and 1% extract added before fermentation) using a yoghurt culture (Laktoflora, Czech Republic) at a rate of one packet per liter of milk. The experiment was repeated three times. Samples were analysed the day after production and after 7 days of storage at 6 °C. Lactobacilli counts were determined using MRS agar, and streptococci counts with M17 agar (both from HiMedia, India). Results showed that all yoghurt samples, both after production and following 7 days of storage, met the legislative minimum requirement of 7 log CFU/g for lactic acid bacteria. Streptococci counts ranged from 8.15 to 8.38 log CFU/g, and lactobacilli from 7.71 to 8.13 log CFU/g. No statistically significant differences were found between the control and experimental groups. In conclusion, there were no differences in lactic acid bacteria counts between the control and test yoghurt samples. Future research should explore higher concentrations of blackberry extracts in yogurts.

Keywords: *yoghurt, lactic acid bacteria, plant extract, Rubus fruticosus*

Acknowledgement: Work was supported by the project APVV-22-0402.

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; xhanuska@uniag.sk
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; miroslav.krocko@uniag.sk

DOI: https://doi.org/10.15414/2025.9788055228310

Changes in the hygienic-nutritional quality of French fries and oil in the frying process

Michaela GABAŠOVÁ, Lucia ZELEŇÁKOVÁ

Supervisor: doc. Ing. Lucia Zeleňáková, PhD.

The aim of the study was investigation of process changes in the hygienic-nutritional quality of deep-frying French fries and oil depending on the deep-frying conditions. Deep-frozen pre-fried French fries primarily intended for catering establishments were deep-fried parallel in rapeseed oil at two different combinations of temperature and time (175°C/4 min and 200°C/3 min) until the limit for total polar contents (TPCs) (24%) was reached. These parameters were analyzed in the oil: TPCs, peroxide and acid value, fatty acid composition. In French fries were examined acrylamide content. Characterisation of experimental variants: K (original packaging), A – C (175°C/4 min after first deep-frying – after exceeding 24% TPCs), B – D (200°C/3 min after first deep-frying – after exceeding 24% TPCs). As part of the TPCs evaluation, rapeseed oil was more stable at a temperature of 175 ˚C/4 min throughout the frying process. Oil burning occurred earlier in all samples at a combination of 200 °C/3 min. Values of peroxide value in rapeseed oil for all types of French fires were similar and ranged from 0.2 to 3.7 meq $O_2.kg^{-1}$. In samples A, C and D, a clearly decreasing trend of peroxide number values was recorded, in samples K only a slight trend. On the contrary, in sample B, an increase in the value of peroxide number was detected. In rapeseed oil used for frying samples B, the acidity number at 175°C/4 min was 0.244 $mg.KOH.g^{-1}$ at the beginning and 0.448 $mg.KOH.g^{-1}$ at the end of the frying process. At 200°C/3 min, the oil showed higher values of the acidity number. It was 0.224 $mg.KOH.g^{-1}$ at the beginning and 0.673 $mg.KOH.g^{-1}$ at the end of frying. Determination of fatty acids within the 11 fatty acids that were present in all samples, the content of erucic acid was detected only in French fries that underwent the first frying. In French fries, linoleic, oleic and palmitic acids prevailed, the content of the others was lower than 5%. Pre-fried French fries were dominated by polyunsaturated fatty acids, in the range of 42.16% (C) to 54.50% (D). After the first deep-frying, the PUFA content decreased by an average of 44% in all examined pre-fried French fries. The opposite trend was recorded for monounsaturated fatty acids, where their content in pre-fried French fries was in the range of 33.38% (D) to 45.07% (C). The content of MUFA increased by deep-frying, as well as in all types of French fries, by an average of 58%. The lowest amount of acrylamide 2.9 $\mu g.kg^{-1}$ was detected in sample K. Comparably high content was found in sample B and D (6.7 and 4.7 $\mu g.kg^{-1}$). Sample C contained 16.7 $\mu g.kg^{-1}$ and the highest starting amount was found in sample A (40.6 $\mu g.kg^{-1}$). The most striking difference was found during deep-frying of fresh French fries. After the first frying at 175 °C/4 min, an increase from 2.9 to 707 $\mu g.kg^{-1}$ was recorded, after reaching TPCs (24%), it even rose to 2464 $\mu g.kg^{-1}$. Even higher values were recorded when frying at 200 °C/3 min with values of 2.9 – 1317 – 3081 $\mu g.kg^{-1}$. A higher amount of acrylamide was detected in French fries fried at 200 °C, but in samples A, B, C, a lower content of acrylamide was detected after the last frying compared to the first frying. Testing frying quality of French fries is vital for health, quality, oil use, and regulations.

Key words: *French fries, deep-frying, food quality and safety, acrylamide, fatty acids, thermo-degradative changes*

Acknowledgement (bold, Times New Roman 10): The study was supported by the Slovak Research and Development Agency [APVV-22-0402]

Contact address: Institute of Food Sciences, Faculty of Biotechnology and Food Science, Slovak University of Agriculture in Nitra, Tr. A. Hlinku 2, 94976 Nitra, Slovakia. gabasova.michaela@gmail.com

SECTION

Plant Production

DOI: https://doi.org/10.15414/2025.9788055228310

Effect of Azoter F and Azoter L on the Sunflower (*Helianthus annus* L.) Yield

Ivan RAVZA, Ivan ČERNÝ, Dávid ERNST, Tomáš VICIAN

Supervisor: doc. Ing. Ivan Černý, PhD.

The aim of the experiment was to compare the effectiveness of the bacterial preparation Azoter F applied to the soil during pre-sowing soil preparation as well as the combination of soil application of the bacterial preparation Azoter F and foliar applied microbial preparation Azoter L at different levels of fertilization on the yield parameters of sunflower. The experiment was conducted in 2023 as a small-plot field trial using conventional sunflower cultivation techniques. It took place at the research-experimental base of the Centre of Plant Biology and Ecology at the FAFR, SUA in Nitra. The site is located in a maize production area at an altitude of 170-175 meters, characterized by warm and dry climatic conditions. Methodologically, the experiment was set up in 5 variants (variant 1: control (unfertilized); variant 2: standard fertilized with full dose of NPK; variant 3: standard fertilized with NPK + pre-sowing bacterial preparation Azoter F (10 l/ha; 150 - 200 l H_2O); variant 4: standard dose of PK, nitrogen dose reduced by 30 % compared to variant 2 + pre-sowing application of the bacterial preparation Azoter F (10 l/ha; 150 - 200 l H_2O); variant 5: N dose reduced by 50 % compared to variant 2, PK dose in line with variant 2 + application of Azoter F (10 l/ha; 150 - 200 l H_2O, applied pre-sowing with immediate incorporation into the soil + Azoter L (10 l/ha; 150 - 200 l H_2O, applied at the 6 - 8 leaf growth stage). Experimental results confirmed the significant effect of pre-sowing application of Azoter F on yield formation of sunflower, as well as the combination of pre-sowing application of Azoter F with foliar application of Azoter L in interaction with different levels of NPK fertilization. The highest yield of achene (3.36 t/ha) was obtained on variant 4 with a reduced N dose of 30 %, in combination with soil application of Azoter F. This variant showed a 13.51 % yield increase compared to the control variant and a 7.00 % yield increase compared to the variant with a full dose of NPK nutrition (variant 2). In variant 3, where standard fertilization was combined with soil application of Azoter F, a yield increase of 8.78 % was achieved compared to the control and compared to the standard fertilized variant 2, the seedling yield increased by 2.54 %. On variant 5 with a significant reduction of the total N dose by 50 %, together with both soil and foliar application of Azoter F and Azoter L, a yield increase of 11.14 % was recorded compared to the unfertilised control and a yield increase of 4.77 % compared to the variant with full NPK nutrition. The lowest sunflower seedling yield (2.96 t/ha) was obtained on the control (unfertilized variant), while the standard fertilized variant achieved only a slight yield increase (+5.74 %) compared to the control. The experiment shows a positive effect of the application of bacterial preparations. The results confirmed that soil application of Azoter F, as well as the combined application (Azoter F - soil application + Azoter L - foliar application), significantly increased sunflower yield. These findings indicate the strong potential of microbial preparations in sunflower cultivation, maintaining its production potential even with reduced nitrogen doses, which also brings significant financial savings on nitrogen fertilization. Future research should investigate the long-term benefits of microbial preparations on the soil, assess the economic efficiency of their use, as well as their impact on the quality of sunflower.

Key words: *sunflower, fertilization, Azoter F, Azoter L, yield*

Acknowledgement: The experiment was carried out in accordance with the research task "Influence of biological material of selected crop species (soybean, maize, sunflower)" on their yield and technological quality – NI/1-12/2024/SPU

Contact address: Ing. Ivan Ravza, Institute of Plant Production, Faculty of Agrobiology and Food Resources, Slovak University of Agriculture in Nitra, Tr. A. Hlinku 2, 949 76 Nitra, e-mail: xravza@uniag.sk

DOI: https://doi.org/10.15414/2025.9788055228310

Weed control in the corn (*Zea mays* L.)

Denis ONUFER

Supervisor: doc. Ing. Štefan Týr, PhD.

Maize is considered the queen of cereals and is one of the most important crops from a global point of view. In Slovakia it is the second most cultivated crop with an area of 150-200 thousand hectares. To achieve the best possible result, it is very important to choose the right variety, location and, of course, the right way of herbicide treatment. The aim of the work is the use of 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 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. 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 pre-emergence 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. 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 and 2024 growing season the herbicides were used in the individual variants as follows: V0: untreated control, V1: Wing P 4.0 l/ha, V2: Lumax 537.5 SE 4.0 l/ha, V3: Kelvin Quattro 0.44 kg/ha + Dash 0.5 l/ha, V4: Principal Forte 0.44 kg/ha+ Dash 0.5 l/ha, V5: Casper 55 WG 0.3 kg/ha + Dash 0.5 l/ha, V6: Arrat 0.2 kg/ha + Dash 0.5 l/ha, V7: Laudis OD 2.2 l/ha. In the V8 variant (technology of the PPD Inovec company), Callisto 100 SC 1 l/ha + Milagro 4 SC l/ha in combination with Šaman 0.5 l/ha. For all variants, a water dose of 400 l/ha was used to obtain the best possible effect. The average yield (2023) achieved from each plot where the experiment was carried out was 8.8 ton per hectare. During the 2023 season, weed species, such as *Chenopodium album* L., *Anthemis arvensis* L., *Echinochloa crus-galli* L. and winter rapeseed were found in the corn stand. In 2023 the effectiveness of the used herbicides in variants V1 to V8 compared to the control was from 78,57% to 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. In 2024, herbicides were applied at the same stages and rates. As this year was very poor in terms of rainfall, this was also reflected in the health condition of the maize and, of course, in the resulting yield, which was in this year averaged only 5.9 tonnes per hectare. In 2024 main weed species in the corn stand were *Chenopodium album* L., *Amaranthus retroflexus*, *Echinochloa crus-galli* L., *Veronica persica*, *Poa annua, Anthemis arvensis* L.

Key words: *maize, herbicide, weed, corn, yield, treatment, experiment*

Contact address: Ing. Denis Onufer, SPU v Nitre, ÚRP FAPZ, Trieda A. Hlinku 2, 949 01 Nitra, denis.onufer@gmail.com

DOI: https://doi.org/10.15414/2025.9788055228310

Boosting Alfalfa productivity: The Impact of Tricho Immun supplemented with Foliar Fertilizer on Amino Acids and Protein Concentration

Ebenezer Ayew APPIAH

Supervisor: Dr. Erika Kutasy, Associate Professor

In the quest to improve biochemical properties, nutritional quality and final yield of crop productivity in an eco-friendly environment, integrating biostimulants in crop production is crucial. A study conducted at the University of Debrecen aimed at exploring the influence of sole trichoderma or combined with foliar fertilizer on protein content and amino acids concentration in alfalfa a key forage crop. The experiment was arranged in a randomised complete blocked design consisting of three treatment levels repeated three times. Data obtained were subjected to analysis variance using Genstat edition 18 where significant means were separated at a 5% probability level using the least significant difference. Our findings showed that the application of tricho immum alone or combined with foliar fertilizer enhances both amino acid concentration and protein content of the alfalfa crop compared to the control. The maximum protein content of 17.52% was obtained by tricho immum alone followed by the combination with foliar fertilizer with 17.18% while the minimum protein of 14.22% was recorded by the control. The study further revealed that tricho immum alone significantly increased protein content by 18.8% while it's combined application with foliar fertilizer also increased protein by 8.18%. A significant increase was noted in amino acid concentration where trich immum alone increased proline by 63.5%, histidine, 33.9% and 15.4% for glycine, while its combination with foliar fertilizer also increased proline by 18.9%, 12.4% for histidine and 0.36% for glycine. These improvements in protein and amino acid concentrations not only improve feed quality but also encourage healthy growth and development and increased the final biomass production. Correlation coefficient values showed that only proline, histidine and glycine had a positive correlation with protein content (r= 0.4773, 0.3884 and 0.3354) respectively. Our study suggested that the application of sole tricho immum or combined with foliar fertilizer could be an effective and sustainable approach to optimize alfalfa productivity while improving the quality of forage with the need to meet the rising demand for high-quality feed by livestock industries.

Key words: *Biostimulant, foliar fertilization, alfalfa productivity, quality traits*

Acknowledgement: This work was supported by the Tempus Public Foundation (Hungary) within the framework of the Stipendium Hungaricum Scholarship Programme.

Contact address: Ebenezer Ayew Appiah[1, 2] Erika Kutasy[2]; [1]Kerpely Doctoral School of Crop Production and Horticultural Sciences, University of Debrecen, Hungary. [2]Institute of Crop Sciences, Faculty of Agricultural and Food Sciences and Environmental Management, University of Debrecen, H-4032 Debrecen, Hungary, Böszörményi Street 138; Email: ayew.appiah@agr.unideb.hu; kutasy@agr.unideb.hu

DOI: https://doi.org/10.15414/2025.9788055228310

Analysing the relationship between coefficient of consolidation and impact value on irrigated cropped chernozemic soils

Ronald KUUNYA[1], Magdoline Mustafa AHMED[1,2], Akasairi OCWA[1], András TAMÁS[1]

Supervisor: Asst. Prof. Péter Ragán, Dr.

Chernozemic soils, rich in organic matter, support crop production in regions like the Great Plains, Argentinian Pampa, and parts of Europe and Asia. However, their loess nature makes them highly susceptible to nutrient loss due to erosion, influenced by factors such as the coefficient of consolidation and impact value. To investigate this, we mounted an EM38 sensor on a metal-free sledge and towed it across an irrigated block of 1-month-old maize, collecting 1,443 readings of soil conductivity. Data analysis using Past4.11 and MedCal software showed a skewness between -0.34 and 2.51, with a significant p-value of 0.0001. These results indicate a pronounced relationship between the soil's coefficient of consolidation and a notable non-normality for the impact value, both within acceptable limits, highlighting the need for further exploration of their interactions and effects on soil health. In conclusion, our findings, supported by a p-value significantly lower than that of the null hypothesis, underscore the importance of concurrently measuring the consolidation coefficient and impact value whenever EM38 sensors are utilised on irrigated chernozemic soils. This dual measurement approach not only enhances the accuracy of soil assessments but also provides a more comprehensive understanding of soil health and dynamics. By integrating these measurements, researchers and practitioners can better evaluate the physical properties of the soil, leading to improved agricultural practices and optimised irrigation strategies. Future research should investigate the impact of different agricultural practices on the dynamics of chernozemic soils, particularly focusing on how cover cropping, no-till farming, and organic amendments influence the coefficient of consolidation and impact value. Additionally, exploring the interactions between soil microbial communities and these geotechnical parameters may provide a more comprehensive understanding of soil health and its implications for crop productivity.

Key words: *chernozemic, sensor, soil conductivity, coefficient, impact value, soil parameters*

Acknowledgement: This work was supported under the TKP2021-NKTA funding scheme with implementation by the Ministry of Culture and Innovation of Hungary from the National Research, Development and Innovation Fund, Project number TKP2021-NKTA-32.

Contact address:
[1]Ronald Kuunya, Akasairi Ocwa, András Tamás, Péter Ragán 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: kuu79ron@mailbox.unideb.hu
[2]A. Ocwa – Email: ocwa.akasairi@agr.unideb.hu

Utilization of DNA markers in characterization of *Amaranthus hypochondriacus* L. × *Amaranthus hybridus* L. var. Plainsman under Cd stress

Dagmar MORAVČÍKOVÁ, Jana ŽIAROVSKÁ

Supervisor: prof. PaedDr. Ing. Jana Žiarovská, PhD.

Amaranthus species are promising plants for phytoremediation due to their ability to cope with stress cause by heavy metals. Understanding heavy metal accumulation in plants and their resilience to stress caused by heavy metals is aided by research on heavy metal-plant interactions, especially at the molecular genetic level. The impact of cadmium toxicity of genomic instability and polymorphism generated by retrotransposons on Amaranthus spp. is unknown. Here, using PBA and CDDP marker techniques, the effects of Cd treatment and Cd treatment with silicium addition on *Amaranthus hypochondriacus* L. x *Amaranthus hybridus* L. var. Plainsman was examined within the framework of the molecular genomic response. It has been demonstrated that both marker approaches react to stressful situations. Following Cd treatment/ Cd + silicium treatment in leaves, alterations were found in the genomic profile of *Amaranthus hypochondriacus* L. × *Amaranthus hybridus* L. var. Plainsman. When compared to PBA, the CDDP showed more variable fingerprints. The BR + BF primer combination generated the highest number of amplified fragments, reaching up to 169. In contrast, the CDDP marker technique with the R3B primer amplified the fewest fragments. Primer combinations R2, R2B, and R3 produced more diverse profiles compared to others. Additionally, variations were observed between biological replicates.

Key words: *Amaranthus*, *heavy metals, DNA markers, fingerprints*

Acknowledgement: Work was supported by the project VEGA 2/0013/22 Amaranth plasticity in response to heavy metals: multi-scale analysis from ecophysiological to molecular aspects.

Contact address: Dagmar Moravčíková, Institute of Plant and Environmental Sciences, Faculty of Agrobiology and Food Resources, Slovak University of Agriculture in Nitra, email: xmoravcikova@uniag.sk

DOI: https://doi.org/10.15414/2025.9788055228310

BBAP amplification profiles of Golden Delicious and Granny Smith apple varieties

Lenka KUČEROVÁ, Lucia URBANOVÁ, Jana ŽIAROVSKÁ

Supervisor: prof. PaedDr. Ing. Jana Žiarovská, PhD.

Cross-reactivity between Bet v 1, a major allergen in birch pollen, and Mal d 1, its homolog in apples, often leads to allergic reactions in individuals sensitized to birch pollen. To investigate the natural genetic variability of apple allergens, the BBAP analysis (Bet v 1 based amplified polymorphism) aimed to detect natural variation among thirteen samples of Golden Delicious and Granny Smith apple varieties sourced from retail chains across eight European countries (Germany, Austria, Slovakia, Serbia, Croatia, Hungary, Italy and Slovenia). Forward and reverse primers (R1, R2, R3, R4, Rd) were employed, and the resulting amplification products were analysed via electrophoresis on a 3% agarose gel. Most samples exhibited monomorphic patterns, suggesting similar isoform profiles, although some differences between varieties were observed. A total of 73 fragments, ranging from 38 bp to 662 bp, were amplified. Profiles for primers FR3 and FR4 could not be successfully synthesised. For the primer pair FRd, fragment sizes ranged from 95 bp to 398 bp, with 26 fragments observed. Primer pair FR1 produced 20 fragments within a range of 181 bp to 662 bp, while primer pair FR2 resulted in 27 fragments ranging from 38 bp to 307 bp. All primer pairs exhibited the expected amplicon with a length of 388 bp. An average PIC value of 0.37 confirmed the high informativeness of the technique. The monomorphic profiles suggest that the environmental impact and varying storage conditions on the studied genes are minimal or negligible, as all samples exhibited similar profiles despite being sourced from diverse countries and retail stores. The identification of unique genetic profiles in certain regions or varieties may provide insights into the allergenic potential of different apple cultivars, contributing to advancements in food safety, allergen management, and the development of hypoallergenic apple varieties.

Key words: *Bet v 1, Mal d 1, variability, Malus domestica, polymorphism*

Acknowledgement: Work was supported by project APVV-20-0058 The potential of the essential oils from aromatic plants for medical use.

Contact address: Lenka Kučerová, Institute of Plant and Environmental Sciences, Faculty of Agrobiology and Food Resources, Slovak University of Agriculture in Nitra, email: xkuceroval1@uniag.sk

In Silico Prediction of miRNA Families Involved in Terpenoid Biosynthesis in Lavender (*Lavandula angustifolia* Mill.)

Simona ČERTEKOVÁ

Supervisor: prof. Ing. Katarína Ražná, PhD.

Short, regulatory RNA molecules known as microRNAs (miRNAs) are one of the key players in the complex processes governing gene expression regulation. Research on their roles in various plants, including modulation of terpenoid biosynthesis, is constantly growing. However, despite monoterpenes being the main components of lavender essential oil, there is no information on the specific miRNAs in lavender (*Lavandula angustifolia* Mill.). In this work, we performed *in silico* prediction of miRNA families present in lavender, with a focus on identifying those most likely involved in monoterpenoid biosynthesis, using publicly available genomic and transcriptomic data. Sequences of plant mature miRNAs and their precursors were obtained from miRBase (https://mirbase.org/download/, version 22.1) and aligned to the reference genome of lavender (GeneBank: GCA_028984105.1) using algorithm BLASTN, with parameters optimized to short sequences. The results were filtered using a custom python script with a defined set of criteria for percentage of identity, coverage, and e-value, with stricter criteria applied specifically for shorter mature miRNAs. The formation of characteristic hairpin structures is an important criterion of miRNA identification and therefore we opted for using RNAfold algorithm to predict secondary structures of sequences that passed the filtering step. Only sequences that formed hairpin structures with minimal free energy were considered to be potential miRNA candidates. This approach led to the identification of nine miRNA families: miR156, miR157, miR159, miR160, miR167, miR171, miR319, miR397, and miR399. To identify potential target genes in lavender, we aligned their mature miRNA sequences with the lavender transcriptome assembly (GenBank: GGRW00000000.1) and with all lavender genes available in NCBI (https://www.ncbi.nlm.nih.gov/). Our analysis suggests that these miRNAs likely regulate various biological processes, including secondary metabolite biosynthesis and responses to biotic and abiotic stress factors. Notably, miR171 appears to regulate the *TPS8* gene, which encodes a monoterpene synthase involved in the production of volatile compounds such as linalool, limonene and geraniol, key components of lavender essential oil. MiR397 was identified as a regulator of the *LAC17* gene, which plays a role in the biosynthesis of lignin, important in cell wall formation and protection against stress. These findings not only enhance our understanding of miRNA involvement in lavender's metabolic pathways but also provide valuable insights for optimizing lavender genotypes with improved therapeutic and industrial properties, potentially advancing applications in pharmaceuticals, cosmetics, and agriculture.

Key words: *miRNA, terpenoid biosynthesis, lavender, in silico prediction, gene regulation*

Acknowledgement: This work was supported by the project 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

DOI: https://doi.org/10.15414/2025.9788055228310

Expression Stability of Reference Genes in Tomato (*Solanum lycopersicum* L.) Under Biotic Stress Using Real-Time PCR

Aqsa ABBAS, Jana ŽIAROVSKÁ

Supervisor: prof. PaedDr. Ing. Jana Žiarovská, PhD.

Pathogenesis-related proteins (PR-10) are widely distributed in the plant kingdom and play critical roles in various physiological processes, including defense responses against pathogens. These proteins can be found in all plant tissues, where they contribute to growth and development, but their expression is notably induced under stress conditions, such as biotic attacks from pests or pathogens. To understand the expression patterns of PR-10 and other related genes, real-time quantitative polymerase chain reaction (RT-qPCR) is a commonly employed technique that allows for accurate and efficient analysis of gene expression levels. However, the effectiveness of RT-qPCR depends significantly on the use of reference genes, which serve as internal controls for normalizing mRNA levels across different samples. Identifying reliable reference genes is crucial for the correct interpretation of RT-qPCR data, as variability in reference gene expression can lead to misleading conclusions. In this study, we evaluated the stability of six reference genes—elongation factor 1-alpha (EF1α), ribosomal protein L33, actin (Act), ubiquitin (Ubi), glyceraldehyde-3-phosphate dehydrogenase (GAPDH), and UK—in tomato (*Solanum lycopersicum*) samples subjected to various biotic stress conditions. We conducted RT-qPCR analysis using SYBR Green to assess the expression levels of these genes in tomato leaves. Our comprehensive analysis revealed that EF1α, L33, and UK exhibited consistent expression across different types of biotic stress, with EF1α emerging as the most stable reference gene among those tested. This stability was validated by comparing its expression with that of a target gene involved in biotic stress response. The findings of this study provide a theoretical foundation for future research focused on understanding functional gene expression changes in response to biotic stress in tomatoes. By establishing reliable reference genes, we enhance the accuracy of gene expression analyses, offering valuable insights into the molecular mechanisms that underlie tomato resistance or susceptibility to various biotic stresses. This work not only contributes to our understanding of plant defense strategies but also has practical implications for developing disease-resistant tomato varieties, ultimately aiding agricultural productivity and sustainability.

Key words: *RT-qPCR, Reference gene, PR-10, Gene expression, Pathogenesis related - proteins*

Acknowledgement: Work was supported by the VEGA 1/0059/24 Chemical properties and biological activity (*in vitro*, *in vivo* and *in situ*) of plant volatile mixtures, their main components and inclusion systems and funded by the EU NextGenerationEU through the Recovery and Resilience Plan for Slovakia under the project No. 09I03-03-V02-00043

Contact address: Aqsa Abbas, Institute of Plant and Environmental Sciences, Faculty of Agrobiology and Food Resources, Slovak University of Agriculture in Nitra, email: xabbas@uniag.sk,

DOI: https://doi.org/10.15414/2025.9788055228310

Distribution and habitats of fast spreading perrenial weed *Sorghum halepense* in Slovakia

Nikola KOTLÁROVÁ

Supervisor: doc. Ing. Pavol Eliáš, PhD.

Sorghum halapense is an extensively distributed weed species that poses a potential threat to agricultural agro-systems. Infested crops experience large yield losses with secondary problems due to the impact of *Sorghum halepense* as an alternative host for diseases and pests. *Sorghum halepense* has high competitiveness, different modes of spread, rapid development and tolerance to herbicides, making it a dangerous weed. Its origins are in the eastern Mediterranean, the Black Sea region and Asia Minor. By being found in different ecotypes, it has been introduced as a weed in all subtropical and warm temperate regions of the world. The aim of this work was to map the distribution of *Sorghum halepense* in Slovakia and point out its increased tendency to spread into agricultural crops, which may have a negative impact on the magnitude of potential yields. In this work we focused on the distribution of *Sorghum helepense* in Slovakia and also on the description of its most frequent occurrence within habitats. In the past, this weed occurred mainly in the area of transport corridors. During field walks we mapped the occurrence of *Sorghum helepense* and recorded the locations in an excel table. After collecting the data, we created distribution maps that we divided into decades over the years. To the current distribution of *Sorghum halepense*, we added historical records from herbaria in Bratislava, Nitra, Prague, and Budapest (Hungary), as well as records from the author of Jehlik. The population increase occurred after 2000. After this year we record occurrence at localities mainly in the Danube Lowland (Kolárovo, Hurbanovo, Nové Zámky). Most recently, we have also recorded the northernmost occurrence in the East Slovakian Lowland, specifically in Podčičva. In the coming years, an increased occurrence of *Sorghum halepense* can be expected, especially on ruderal habitats, especially on roadsides.

Key words: *central Europe, occurance, poaceae, stands*

Acknowledgement: The research was financially supported by grant VEGA 1/0359/22.

Contact address: Nikola Kotlárová, Institute of Plant and Environmental Sciences, Faculty of Agrobiology and Food Resources, Slovak University of Agriculture in Nitra, xkotlarova@uniag.sk

DOI: https://doi.org/10.15414/2025.9788055228310

Impact of the Light Spectrum on Photosynthesis and Secondary Metabolite Levels in Selected Microgreens

Lucia JASENOVSKÁ[1], Dominika MLYNÁRIKOVÁ VYSOKÁ[1], Mária BARBORIČOVÁ[1], Andrej FILAČEK[1], Marián BRESTIČ[1], Marek KOVÁR[1] and Marek ŽIVČÁK[1]

Currently, microgreens are considered one of the five most profitable crops worldwide. We include them among the edible seedlings of various types of vegetables, flowers, and culinary herbs. Light-emitting diodes (LEDs), which are mainly used in controlled agricultural environments such as vertical farms, have shown great potential for their growth and synthesis of health-promoting phytochemicals. By manipulating the light spectra, it is possible to specifically influence the production of plant species microgreens, which show enormous variability in how they behave regarding the conditions of the light environment. The aim of this study was to evaluate the influence of different light spectra (blue, red and white light) on the content of bioactive compounds of microgreens (carrot, celery, chervil, cilantro, dill, borage, marigold, fennel, parsley). In the experiment, indices of chlorophyll (SFR_R), anthocyanins (ANTH) and flavonoids (FLAV) were measured using a Multiplex® 3 fluorimeter. The analysis showed differences in the response of individual types of microgreens to light spectra. White light led to increased chlorophyll index (SFR_R) values in most species, especially carrots, indicating its positive effect on chlorophyll accumulation. On the other hand, red light caused a decrease in SFR_R values in most species, indicating less efficient photosynthetic activity. Flavonoids (FLAV) showed a similar trend, where white light statistically significantly increased their concentration, especially in parsley. In the case of anthocyanins (ANTH), the differences between the light spectra were less pronounced, while the total values of anthocyanins were similar in all spectra. The lowest values of anthocyanin content in all light spectra were found in the borage plant. However, white light showed an increase in ANTH values for species such as marigold, parsley, and dill, which may indicate its potential to promote anthocyanin synthesis. The results indicate that light spectra have a statistically significant influence on the production of bioactive compounds and correctly selected light conditions can optimize their nutritional and functional properties. The research provides important insights for growers looking to improve the quality of microgreens through controlled light conditions.

Keywords: *light emitting diodes; light spectrum ; phytochemical content; secondary metabolites; microgreens*

Contact address: [1] Slovak University of Agriculture in Nitra, Institute of Plant and Environmental Sciences

DOI: https://doi.org/10.15414/2025.9788055228310

Quantification of zinc transfer to soybean (*Glycine max*) after foliar application of zinc in ionic and nanoparticulate form

Viktor STRAKA[1], Marek KOLENČÍK[1], Dávid ERNST[2], Veronika ŽITNIAK ČURNÁ[2]

Nowadays, the constantly increasing crop production requires new innovative solutions for plant nutrition, which is exemplified by the application of nanopreparations (NPP) or nanoparticles (NP) in real agronomic practice. Their advantage is the lower applied concentration or gradual release. This leads to a more efficient use of nutrients and thus to a reduction of the ecological impact on the environment compared to conventional fertilisers. One of the many micronutrients applied is zinc (Zn). However, it can act as a potentially toxic metal when overconcentrated, so it is important to monitor its transfer, transformation, metabolism or accumulation in the soil-plant system. Based on the above, our objective was to quantify its content in soil and phytomass of soybean *Glycine max (L.) Merrill* after its foliar application in a range of concentrations, i.e., 0 mg/kg-1 (control), 15 mg/kg^{-1} and 150 mg/kg^{-1} for both nanoparticulate (ZnO-NP) and ionic forms ($ZnSO_4$) and also as a combination of Zn and P nanoparticles (of which Zn at concentrations of 7.5 mg/kg^{-1} and 75 mg/kg^{-1}, respectively). Our results showed that an increase in Zn content in soybean plants was measured on each variant compared to the control. However, the most significant increase in Zn was observed in plants treated with ZnO-NP and at all concentrations. A significant increase in the amount of Zn in the plants was also measured after application of higher concentration of $ZnSO_4$. On the contrary, higher Zn levels were not recorded in the soil for any of the treatments compared to the values measured before application. This suggests effective Zn delivery to soybean without the potential hazard of contamination of the soil system. Therefore, we can conclude that the NP applied by us, the form of NP delivery as foliar nutrition or the range of concentrations meets the more stringent criteria of the principle of precision and sustainable agriculture with desirable environmental impact on the soil.

Keywords: *soybean, zinc, nanoparticles, foliar application*

Contact address: [1] Institute of Agrochemistry and Soil Science, Faculty of Agrobiology and Food Resources, Slovak University of Agriculture in Nitra, Trieda Andreja Hlinku 2, 949 76 Nitra, e-mail: straka.viktor.spu@gmail.com

[2] Department of Crop Production, Faculty of Agrobiology and Food Resources, Slovak University of Agriculture in Nitra, Andrej Hlinku 2, 949 76 Nitra

Acknowledgements: The work was supported by the project VEGA 1/0655/23 and the research activities were financed by the project of the Grant Agency of the Faculty of Agrobiology and Food Resources, SPU in Nitra "GAFAPZ 08/2023 - *Evaluation of the quality of field crops by the effect of foliar application of inorganic NPs as a new generation foliar nutrition"* and "GA FAPZ 09/2023 - *Research on the effect of foliar application of NPs on selected indicators of field crop production"*.

DOI: https://doi.org/10.15414/2025.9788055228310

Influence of the variety and biostimulant ExelGrow® on the yield and quality of sugar beet

Nika BRIEDIKOVÁ

Supervisor: prof. Ing. Vladimír Pačuta, CSc.

Sugar production in Slovakia has a long, continuous, almost 200-year tradition. Sugar beet has to deal during its growing season with mainly climate changes, which lead to an increase in average monthly and annual temperatures, to an uneven distribution of precipitation from a geographical and temporal point of view. A combination of suitable genotypes, optimal agrotechnical interventions, including nutrition, protection and the use of auxiliary preparations, such as biostimulants, can be one of the ways too, in difficult environmental conditions, to achieve optimal sugar beet production. Due to bans on the use of various active substances in the wide range of chemical products used is becoming harder to achieve economically suitable outcome from sugar beet cultivation. The multifactor trial experiment was carried out at the Research and Experimental Base of SPU Nitra in the Center of Plant Biology and Ecology in the cadastre of Dolná Malanta. The small plot trial was based on the split block method. The main goal of the experiment is to evaluate the influence of the variety and the selected biostimulant 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 ExelGrow® were used. Both varieties are from German plat breeder and being commercially sold in Slovakia. 'Fischer' is sugary variety and 'Fabius' is normal-sugary. ExelGrow® is a unique natural biopreparation based on the content of fermented brown algae Ascophyllum nodosum, increasing the yield and quality of plant production. The preliminary results were evaluated from the experimental observations from the years 2021 and 2022, by using selected statistical methods ANOVA and Tukey's test. The influence of year, variety and the effect of biopreparation on selected sugar beet parameters was evaluated. From the two-year experiment, it can be deduced that the selected parameters of sugar beet production were influenced by the year and the of course the weather, the difference in sugar beet varieties and also by the application of the biostimulant. With the normal- sugary variety Fabius, the biostimulant had a greater effect on improving the quality parameters of the sugar beet than with the sugary variety Fisher. In any case, the application of the biostimulant on sugar beet varieties has statistically proven an improvement in the performance and quality of sugar beet.

Keywords: *sugar beet, variety, biostimulant, yield, quality, sugar content, beet production*

Acknowledgement: The research was founded by grant SMARTFARM 313011W112

Contact address: Nika Briediková, Faculty of Agrobiology and Food Resources, Slovak University of Agriculture in Nitra, xbriediková@uniag.sk

DOI: https://doi.org/10.15414/2025.9788055228310

Effect of Foliar Biostimulant on Quantitative and Qualitative Parameters of Sugar Beet Production at Donau Farm Kalná, s.r.o.

Daša KUBATKOVÁ

Supervisor: prof. Ing. Ladislav Ducsay, Dr.

The basic research objective of the thesis observation, in 2022 at the agricultural company Donau farm Kalná, s.r.o. a field trial was established on an experimental basis, the aim of which was to determine the effect of a biostimulant made from humic bases on quantitative parameters (bulb yield, production of polarizing sugar and white sugar), qualitative parameters (sugar content, white sugar yield, content of α-aminitrogen and molasses-forming elements - sodium, potassium), respectively for physiological parameters (content of nutrients in sugar beet leaves and tubers). In the field experiment, the genetically monocot variety Lucius was monitored. The field trial on an experimental basis was established on 08.04.2022 in three repetitions using the split block method. Sugar beet was treated with a foliar biostimulant Lexin with active substances humic substances and fulvic acids 6%, auxin 0.25% (α-naphthylacetic acid) in phase 33 of the BBCH biostimulant was applied on the experimental plot of variants 1 and 2, in phase 39 of the BBCH, the biostimulant was applied on the experimental plot of variant 2, at an application rate of 0.25 l/ha. The field operation experiment with sugar beet was based on the block method in three repetitions. The total area of the established experiment was 108 x 539.9 m (58,300 m2), which represents 5.83 ha of the total area of 25.84 ha. The experimental plots had the following area, control variant 36 x 608 m (2.19 ha); variant 1x applied biostimulant 36 x 525 m (1.89 ha); variant 2x applied biostimulant 36 x 486 m (1.75 ha). As a pre-crop for sugar beet, summer wheat and winter wheat were selected, after the harvest of which the post-harvest residues together with chicken droppings were incorporated into the soil as a substrate. In the fall, potassium chloride was applied in a dose of 100 kg/ha and incorporated by plowing. In the spring, soil samples were taken (from a depth of 0.3 m). The goal of the spring pre-sowing soil preparation was to prepare an optimal, fine-grained soil structure for the proper establishment of the stand and the incorporation of DASA fertilizer at a dose of 200 kg/ha. Sowing of sugar beet was done with a 24-row precision seed drill with a seeding of 125,000 plants/ha, in a 0.45 x 0.18 m planting clip. During the growing season, leaves were taken 3 times for nutrient content analysis, and after harvesting, tubers were also analysed for nutrient content. Harvesting was carried out at the technological maturity of sugar beet on 15.11.2022. The average yield of sugar beet in the control field reached the level of 83,11 t/ha. The highest value of the sugar beet yield of 86,20 t/ha was found in variant 2x used biostimulant, which represents an increase compared to the control by 3,70 %, and the sugar content in variant 2x used biostimulant reached the level of 17,01 %, which represents an increase over the control by 2.40 %. The average yield of polarizing sugar in the control variant reached the level of 13.80 t/ha, the highest value over the control by was found in variant 2x used biostimulant by 0.86 t/ha, in variant 1x used biostimulant was higher than the control by 0.6 t/ha. The average yield of white sugar in the control variant reached the level of 12.05%, the highest value was found in variant 2x used biostimulant by 1.98%, in variant 1x used biostimulant, it was higher than the control by 1.54 %. The average yield of white sugar in the control variant reached the level of 10.01 t/ha, the highest value of the white sugar yield compared to the control was found in variant 2x used biostimulant by 2.08 t/ha, in variant 1x used biostimulant, it was higher than the control by 1.64 t/ha. From the point of view of evaluating the content of molasses-forming substances (K+ + Na+) and α-aminonitrogen, we can state that more favorable, lower values were recorded in the control variant K+ 3.36 mmol/100g, Na+ 3.59 mmol/100g and α-aminonitrogen 1.30 mmol/100g. In the case of biostimulant application, variant 2x used biostimulant with values

DOI: https://doi.org/10.15414/2025.9788055228310

of K+ 3.95 mmol/100g and Na+ 3.53 mmol/100g turns out to be the best, since in variant 1x used biostimulant the value of potassium increased to the level of K+ 4.90 mmol/100g, which is an undesirable phenomenon using the total sugar content and the highest value of α-aminonitrogen, was recorded in variant 2x used biostimulant of 1.35 mmol/100g. Values of α-aminonitrogen are with low deviations. Just before the first application, sugar beet leaf samples were taken. The content of N, P, K, Ca, Mg and other microelements in the above-ground dry matter was determined in the laboratory. The samples were taken and processed in three terms during the vegetation. On 07.06.2022, 22.07.2022 and 24.09.2022. The content of N and K continuously decreased during the vegetation, on the contrary, the content of Ca and Mg increased, only in variant 2x used biostimulant the content of Mg decreased. The content of Na rose towards the end of the growing season, which is an undesirable phenomenon. The value of potassium was remarkable in the variant with one biostimulant application. From the point of view of evaluating the content of nutrients in 100% dry matter. tubers, we can state that more favorable values of the main nutrients N, K and Ca were recorded in the variant with two biostimulant applications, as the values were N 6,839 mg/kg, K 4,04 mg/kg, Ca 738 mg/kg and the ash content is the lowest. The lowest values of the content of nutrients N, K, Ca and ash in fresh sugar beet bulbs were in the variant with two applications of the biostimulant N 1,904 mg/kg, K 1,125 mg/kg, Ca 218 mg/kg. The highest values were recorded in the variant with one biostimulant application at the level of N 2,198 mg/kg, K 1,335 mg/kg, Ca 254 mg/kg. The sodium content gradually decreased with increasing biostimulant applications. From the point of view of an objective assessment of the effectiveness of the biostimulant Lexin on quality and quantity, it is insufficient to assess only one-year results, because they do not take into account the impact of the growing year, which was extremely dry from the fall of 2021, which until the end of July 2022. The beet crops suffered from a lack of physiologically active water and drought, which caused their physiological death during the summer of 2022. The autumn of 2022 followed with intense rainfall and the harvesting of sugar beet stands, which began to retrovegetate and produce new leaves. The intake and distribution of nutrients was extremely difficult, and their physiological action was limited by the lack of water, also the lack of precipitation caused severe drying of the soil. We note, however, that in the given tested period we observed only a slight increase in parameters, depending on the date and type of preparation used. In conclusion, from the overall evaluation of the experiment, we can state, based on the results, a positive effect on the quality and quantity of the sugar beet harvest. Research on various biostimulants proves that they have the ability to improve plant growth and development, increase nutrient intake, yield and water content, while improving the nutritional value and quality of their production.

Key words: *sugar beet, biostimulant, quality, nutrition, harvest*

Acknowledgement: Work was supported by the financial resources of the Institute of Agrochemistry and Soil Science. Heartfelt thanks to Erik Ivanič, agronomist of Donau farm Kalná s.r.o. for the willingness to carry out the experiment, helpfulness and help in providing important information.

Contact address: Daša Kubatková, Faculty of Agrobiology and Food Resources, Slovak University of Agriculture in Nitra,

SECTION

Animal Production

DOI: https://doi.org/10.15414/2025.9788055228310

Growth Performance of Hybrid African Catfish *Heteroclarias* Cultured on BSF Larval-Based Diets

Christopher TEYE-GAGA, Péter István MOLNÁR, Milán FEHÉR, Elshafia Ali Hamid MOHAMMED, Péter BÁRSONY

Supervisor: Péter Bársony

The rising cost of fishmeal and concerns about its sustainability have led to efforts to explore alternative ingredients that could partially replace it. The Black Soldier Fly (BSF), *Hermetia illucens* larvae hold potential due to their high protein and fat contents. This study evaluated the growth performance of hybrid catfish (*Heteroclarias*) cultured on BSF larval-based diets. The experiment was conducted in a recirculating system, circular plastic tanks (350 L) in a completely randomized design. Four isonitrogenous (400 gkg^{-1} crude protein) and isolipidic (140 gkg^{-1} crude fat) diets were formulated where fishmeal was replaced at 0, 25, 50, and 75% with BSF larval meal and fish oil was completely replaced with corn oil in the test diets. Fish (initial body weight of 200±25 g, 15 fish per tank, 4 treatments, 3 replicates,) were fed at 3% body weight for 8 weeks. All diets were accepted by fish. Fish fed BSF 50 diet had the highest final mean body weight, but the difference was not significant ($p>0.05$) from those fed the Control diet and BSF 25 diet. Fish fed BSF 75 diet had the lowest mean body weight, which was significantly different ($p<0.05$) from the other treatments. There were no significant differences ($p>0.05$) in the FCR among the dietary treatments. The findings of this study suggest that BSF larval meal may partially replace dietary fishmeal up to 50% (200 gkg^{-1}) and corn oil may completely replace fish oil without exerting negative impacts on growth and nutrient utilization of hybrid African catfish, *Heteroclarias.*

Key words: *fishmeal, fish oil, black soldier fly, corn oil, growth performance*

Acknowledgement: Christopher Teye-Gaga and Elshafia Ali Hamid Mohammed are recipients of Stipendium Hungaricum Scholarship by the Tempus Public Foundation. The authors are grateful to Henrik Csokmei, Győző Seress, and John Kiguru, for their assistance during the culture experiment.

Contact address: Christopher Teye-Gaga, Fish Biology Laboratory, University of Debrecen, Boszormenyi ut 138, Debrecen, 4032, Hungary, email: christopher.teye.gaga@agr.unideb.hu

DOI: https://doi.org/10.15414/2025.9788055228310

Utilization of genomic information for the management of genetic diversity in livestock populations

Adrián HALVONÍK, Nina MORAVČÍKOVÁ, Monika CHALUPKOVÁ, Hana VOSTRÁ-VYDROVÁ, Luboš VOSTRÝ, Radovan KASARDA

Supervisor: doc. Ing. Nina Moravčíková, PhD.

Maintaining genetic diversity enables continuous improvement through selective breeding. A diverse gene pool provides a buffer against unforeseen challenges such as diseases, climate fluctuations, or changes in production systems. Intensive breeding programs rely on a narrow genetic base, which can decrease long-term genetic gain and sustainability of populations. For those reasons maintaining a certain level of genetic diversity and inbreeding in livestock populations is an essential part of breeding programs. Newly available technologies, such as genotyping, can serve as highly effective tools for monitoring and managing genetic diversity. However, incorporating genetic diversity estimators derived from genomic data into breeding programs remains an unsolved task. We address this gap by designing a genomic index that can serve as selection criteria for genetic diversity in breeding schemes. The first component of this index was the inbreeding coefficient calculated from runs of homozygosity. Second was the average relatedness of individual with reference population. The last one was a newly invented indicator that evaluates how a given individual influences the frequencies of alleles at risk of diversity loss. Simulations of the breeding programs implementing the proposed genomic diversity index were performed on a model population of dairy cattle. This population was created based on real genomic data of 2129 Holstein cattle. The effect of proposed index on the genetic diversity of the population was evaluated by the observed heterozygosity (H_o) and inbreeding coefficient ($F_{ROH>4MB}$). We tested multiple ways of incorporating genomic index into breeding schemes. Subsequently, the results of these breeding programs were compared with each other and with a scheme where selection was based purely on EBVs. Depending on the method of utilization of the index, average values of $F_{ROH>4MB}$ and H_o ranged from 7.02% (±3.83%) to 8.40% (±3.70%) and from 0.33 (± 0.16) to 0.35 (± 0.15), respectively. When we compared these results with the population where the selection was based only on EBVs, with an average $F_{ROH>4MB}$ of 25.81% (±3.99%) and an average H_o of 0.26 (±0.19), we observed a significant improvement in genetic diversity. These results suggest that the implementation of diversity estimators derived from genomic data into breeding programs is possible. Despite these findings, it is necessary to mention that the specific composition of the index and its application in a breeding program can strongly influence its successful usage.

Key words: *breeding program, genetic diversity, inbreeding, sustainability*

Acknowledgement: This research was supported by the projects APVV-20-0161, APVV-17-0060, DS-FR-22-0016 and 8X23019.

Contact address: Ing. Adrián Halvoník, Institute of Nutrition and Genomics, Faculty of Agrobiology and Food Resources, Slovak University of Agriculture in Nitra, email: xhalvonik@uniag.sk

DOI: https://doi.org/10.15414/2025.9788055228310

Utilization of genomic data in breeding value estimation for mastitis on selected farms – a simulation study

Monika CHALUPKOVÁ, Nina MORAVČÍKOVÁ, Adrián HALVONÍK, Radovan KASARDA

Supervisor: prof. Ing. Radovan Kasarda, PhD.

Genomic evaluation is a state of the art method that uses genetic information to estimate breeding values (GEBVs) with higher reliability than the breeding values (EBVs) from conventional models. With advancements in computer technology and imputation techniques it is now possible to simulate the genome of animals in a given population. The study aimed to estimate GEBV for mastitis using ssGBLUP model with application of genomic data simulated in the environment of the AlphaSimR package in R. Field veterinary diagnoses were recorded in form of veterinary diaries in paper or software form. Phenotypic data were collected from 2018 to 2023 at 6 selected Holstein farms, which are among the Top 50 farms in Slovakia. Mastitis was recorded as a binary variable: 0 representing a cow without any case of mastitis during the 305-day lactation period, and 1 representing a cow with at least one case of mastitis during the 305-day lactation period. Based on lactation data and calving dates, cows were divided into separate datasets for the years 2018 to 2023. Generation of genomic information was performed in several subsequent steps. For each animal, a total of 28 chromosomes, 10 QTLs, and 1700 SNPs were simulated. In the AlphaSimR the first step was to create a founder population of dams and sires i.e. dams were mated to sires for 5 generations, and genotype information was developed for offspring in the final generation. Additionally, were retrieved 2 generations of pedigree information. Further, quality control of genomic data was made in PLINK 9.1. After quality control were obtained from 40021 to 40449 SNPs in the particular subsets of data. In the model equation were included the fixed effect of parity, joint effect of year and season, the fixed effect of the herd, the additive effect of the animal, and the residual effect. Observed genomic breeding values (GEBV) of mastitis for cows under evaluation ranged from 50.55 to 136.61 in 2018, 53.35 to 138.46 in 2019, 59.99 to 144.44 in 2020, 50.13 to 132.29 in 2021, 50.15 to 128.36 in 2022, and 62.92 to 134.88 in 2023. The reliability of GEBV ranged across years, from 0.0123 in 2018 to 0.0289 in 2021. Use of simulated genomic data in estimation of GEBVs for health traits such as mastitis increase their reliability.

Key words: *Holstein breed, genomic data, simulation, genomic breeding values, reliability*

Acknowledgement: This work was funded by projects DS-FR-22-0016 and APVV-20-0161. We also would like to thank the Breeding Services of the Slovak Republic s.e. and Agromont Nitra for providing the data**.**

Contact address: Monika Chalupková, Institute of Nutrition and Genomics, Faculty of Agrobiology and Food Resources, Slovak University of Agriculture in Nitra, e-mail xchalupkovam@uniag.sk

DOI: https://doi.org/10.15414/2025.9788055228310

Qualitative differences in stallion ejaculate depending on age

Monika ŠMONDRKOVÁ, Marko HALO, Eva MLYNEKOVÁ, Marko HALO jr., Adam SALEM, Monika LÍŠKOVÁ, Richard FAZEKAŠ, Karolína FAZEKAŠOVÁ

Supervisor: prof. Ing. Marko Halo, PhD.

The breeding performance of stallions after their sports career is a crucial factor for their inclusion in breeding programs. Stallions are typically selected for breeding based on their sports achievements or pedigree, rather than on the quality of their ejaculate. Consequently, little attention is paid to their reproductive parameters. The inclusion of a proven stallion in breeding programs can contribute to the advancement of equestrian sports and enhance the quality of horses in competitive events. On the other hand, the age of the stallion is often a major factor influencing the reproductive parameters of ejaculate. The aim of our study was to compare the quality of ejaculate among three age groups of stallions and highlight the importance of proper breeding management for stallions. The research was conducted at a stallion station in Germany. We categorized 24 stallions into three age groups: the first group (n=8) consisted of stallions aged 3-5 years old, the second group (n=8) included stallions aged 6-11 years old, and the third group (n=8) consisted of stallions aged 12-25 years old. The stallions were housed in individual stalls with straw bedding. They were fed three times a day with high-quality hay and an energy-dense concentrate supplemented with vitamins. A mineral lick was available in each stall, and water was provided ad libitum. Ejaculate was collected six days a week in a dedicated breeding room, with stallions mounting a phantom. The ejaculate was collected using an artificial vagina (Hannover, Minitube, Germany), immediately filtered through specialized filter paper, and its volume and concentration were measured (Photometer, Minitube). Dilution was performed using a pre-warmed extender (Kenny's extender), and sperm motility was assessed. Statistical analysis was carried out using the Wilcoxon rank-sum test. In the parameters studied, we found statistical significance ($p<0.05$) for ejaculate volume and motility when comparing all groups. The average ejaculate volume for the first group was 38.49 ml, which was 16.42 ml lower than in the third age group. The second group had an average volume of 46.81 ml. The highest sperm concentration was found in the youngest stallions, with an average of 256.17 $\times \mathbf{10^6}$, representing a 44% higher value compared to the stallions in the third group. The second age group had a sperm concentration 20% higher than the third group and 13% lower than the youngest stallions. Sperm motility across all groups ranged from 59-62%, with no statistical significance observed. Based on the results, it is evident that age affects both the volume and concentration of sperm, which are crucial for the production of insemination doses. It is often challenging to include older stallions in breeding programs due to their lower sperm concentration, making advanced biotechnological methods, such as deep horn insemination or the use of ICSI. Proper breeding management for older stallions is essential to improve testicular function, which can increase or extend the stallion's breeding potential.

Key words: *stallion, age, semen, concentration, volume, motility, reproductive parameters*

Acknowledgement: The work was carried out with the financial support of the project VEGA 1/0437/24, GA FAPZ SPU 028SPU-4/2023

Contact address: Monika Šmondrková, Institute of animal husbandry, Faculty of agrobiology and food resources, Slovak university of agriculture in Nitra, e-mail: xsmondrkovam@uniag.sk

DOI: https://doi.org/10.15414/2025.9788055228310

Effects of genotype on external and internal egg quality traits

Aneta LELÁKOVÁ[1], Cyril HRNČÁR[1], Ondrej HANUŠOVSKÝ[2]

Supervisor: doc. Ing. Cyril Hrnčár, PhD.

Currently, there is a growing interest in animal products from more sustainable agricultural practices, which may include the use of local breeds. In addition, it is important to preserve biodiversity and indigenous chicken breeds are naturally well adapted to local environmental conditions. This study was conducted to evaluate the egg quality traits of dual-purposes chicken breeds (New Hampshire, White Oravka, and White Plymouth Rock) and Lohman brown classic commercial hybrid laying hen. A sample of 60 eggs from each genotype was collected randomly to determine egg quality every 30 days in period of 210 days. The hens were placed to its own covered shelters with straw litter and with access to a grass paddock; feeders and drinkers were available both outdoors and indoors. Hens were placed at stocking density of 8 birds per m^2. The hens of all genotypes were fed commercial feed mixture and birds had available drinking water and feed mixture *ad libitum*. The analyse was realized in laboratory of Institute of Animal Husbandry, SUA in Nitra. External and internal characteristics of the eggs and the egg components such as weights, egg shape index, eggshell strength, eggshell thickness, albumen index, Haugh units, yolk index, yolk color, and albumen and yolk percentage were analysed. The Plymouth Rock White breed produced eggs with a lighter egg weight and lower Haugh unit values than the remaining native breeds ($P<0.05$). The commercial hens produced eggs that were found to be more rounded higher albumen index a Haugh unit values than eggs from the three pure hens. In addition, the Lohman brown classic commercial hens also produced eggs with higher eggshell weight and percentage than the New Hampshire, White Oravka, and White Plymouth Rock ($P<0.05$). No differences were found in the egg shape index and yolk color among genotypes ($P>0.05$).
The performed analysis showed that the eggs from these native genotypes correspond to the quality of the commercial product in many characteristics. In markets where locally bred eggs are available, consumers are buying a high-quality product while helping to expand local genetic resources and investing in local farmers.

Key words: *genotype, hen, breed, hybrid, egg, egg quality*

Contact address: [1]Aneta Leláková, Institute of Animal Husbandry, Faculty of Agrobiology and Food Resources,Slovak University of Agriculture in Nitra, Tr. A. Hlinku 2, 949 76 Nitra, Slovak Republic, xlelakova@uniag.sk
[1]Cyril Hrnčár, Institute of Animal Husbandry, Faculty of Agrobiology and Food Resources,
Slovak University of Agriculture in Nitra, Tr. A. Hlinku 2, 949 76 Nitra, Slovak Republic, cyril.hrncar@uniag.sk
[2]Ondrej Hanušovský, Institute of Nutrition and Genomics, Faculty of Agrobiology and Food Resources, Slovak University of Agriculture in Nitra, Tr. A. Hlinku 2, 949 76 Nitra, Slovak Republic, ondrej.hanusovsky@uniag.sk

DOI: https://doi.org/10.15414/2025.9788055228310

Monitoring of udder health of goats in Slovakia

Barbora GANCÁROVÁ, Kristína TVAROŽKOVÁ, Vladimír TANČIN

Supervisor: prof. Ing. Vladimír Tančin, DrSc.

The main economic and health problem in goats is mastitis, especially in the subclinical form. However, monitoring udder health by somatic cell count (SCC) followed by bacterial cultivation in goats is not as common as in dairy cows. The aimed of the research was to study the relationship between SCC and the presence of mastitis pathogens in goat milk during the period 2022-2024. A total of 987 half-udder milk samples were obtained from 5 goat farms in Slovakia. The presence of pathogens was determined by cultivation and bacterial identification using MALDI-TOF MS. Fossomatic 7 was used to determine SCC. To evaluate the frequency distribution of the samples, the following groups of SCCs were considered: SC1 < 500 x 10^3, SCC2 ≥ 500 < 1000 x 10^3, SCC3 ≥ 1000 < 2000 x 10^3, SCC4 ≥ 2000 x 10^3 cells.mL^{-1}. The occurrence of individual milk samples in SCC1 was 42.2%, 17% in SCC2, 16.7% in SCC3 and 24% in SCC4. Of the total number of samples, 23% were bacteriologically positive. The most frequently identified pathogens were *Staphylococcus* spp. especially non-aureus staphylococci and mammaliicocci (NASM). Among the NASM, *Staphylococcus epidermidis* (40.28%), *Staphylococcus caprae* (27.49%) and *Staphylococcus simulans* (10.43%) were the most prevalent species. Only 2 samples were positive for *Staphylococcus aureus*. Despite the fact that SCC in goat milk could be affected by many factors a higher occurrence of pathogens was identified in both SCC3 and SCC4 as compared with SCC1 and SCC2. However, approximately 34.84% of uninfected quarters had SCC≥1000 x 10^3 cells.mL^{-1}. As with all biological data, errors occur in the diagnosis of intramammary infection because some pathogens cannot be identified by standard bacteriological procedures or some inhibitors as residues of antibiotics could inhibit bacterial growth. In conclusion, at present, to set a specific SCC that absolutely predicts the presence or absence of infection in goats is under scientific discussion, and therefore further studies are needed to better understand the relationship between SCC and mastitis-causing pathogens.

Key words: *udder health, goat, pathogens, somatic cells, mastitis*

Acknowledgement: Work was supported by the APVV-21-0134, VEGA 1/0597/22 and by the GA FAPZ 06/2023

Contact address: Barbora Gancárová, Institute of Animal Husbandry, Faculty of Agrobiology and Food Resources, Slovak University of Agriculture in Nitra, Trieda Andreja Hlinku 2, Nitra, Slovak Republic, xgancarova@uniag.sk

DOI: https://doi.org/10.15414/2025.9788055228310

The effects of birth season and sire line on the pig performance

Daniel RAJČOK, Ivan IMRICH

Supervisor: doc. Ing. Ivan Imrich, PhD.

Pig performance monitoring provides breeders with important information about the pigs in the breeding process. Based on the evaluation of the parents, we can select individuals with better genetic predispositions for the next reproduction. The aim of our work was to evaluate the effect of season of birth and sire line on selected performance traits of pigs. The following parameters were evaluated: avarage daily gain (ADG)($g*day^{-1}$), back fat thickness (cm) and lean meat content (%). During the years 2023 and 2024, 73 pigs of the large white breed were monitored. We divided the period of birth into 3 periods (summer, autumn and winter), and the sire lines monitored were 3046 (n=20) and 3070 (n=53). Backfat thickness and muscle proportion were assessed using an ATLAS Dual head scanner (Moons, Austria) ultrasonographic device. The results showed that the highest ADG was found in pigs born in autumn, whereas pigs born in summer had significant the lowest ADG (724.7±92.5 $g*day^{-1}$ vs. 618.97±22.36 $g*day^{-1}$) ($p<0.01$). Back fat thickness was significant the highest in animals born in summer (0.836±0.15 cm) and the lowest in winter (0.483±0.18 cm) ($p<0.01$). The significant difference was also observed in lean meat content ($p<0.01$), where the highest percentage was in animals born in winter (63.82±1.12 %). The results showed that sire line had a significant effect ($p<0.01$) on ADG (sire line 3046: 638.61±11.77 $g*day^{-1}$ vs. sire line 3070: 698.23±7.56 $g*day^{-1}$). The sire line 3046 had a back fat thickness of 0.694±0.04 cm, and line 3070 0.64±0.02 cm, but the difference was not significant ($p>0.05$). Lean meat content was almost the same in the studied lines (sire line 3046: 62.83±0.34% vs. sire line 3070: 62.35±0.22%) ($p>0.05$). Our measurements showed that there were statistically significant interactions between season of birth and sire line in the studied traits ($p<0.01$). Hence, it can be concluded that pig performance is significantly influenced by the environmental conditions of the farming environment in addition to genetic traits and the results of this work can be beneficial to better understand the factors affecting production performance in pig farming.

Key words: *back fat thickness, lean meat content, season of birth, sire line*

Acknowledgement: This study was supported by the 06-GA-SPU-2024 project.

Contact address: Daniel Rajčok, Institute of Animal Husbandry, Slovak University of Agriculture in Nitra, xrajcok@uniag.sk

DOI: https://doi.org/10.15414/2025.9788055228310

Assessment of the quality of the environment and primary zoohygienic factors influencing of the standards of the breeding facilities oof animals reared ex-situ.

Viera MADAJOVÁ, Andrej DUCHOŇ

Supervisor: prof. Ing. Vladimír Tančin, DrSc.

High standard of animal welfare in zoos is currently not only the need but also the necessity. Despite an increase of recommendations employing „best practice“ examples from abroad, each zoo must take into account their own options how to ensure, that the physical, psychological and social needs of the animals are met. There are several associations of zoos and aquariums in the world and all of them have some species-specific standards to ensure, that facilities provided the best care for collection animals. The National zoological garden Bojnice is associated in EAZA (The European Association of Zoos and Aquaria) and WAZA (The World Association of Zoos and Aquariums), which had produced an animal welfare strategy institutional welfare assessment programme. Much of the welfare work in the past has been done on farm animals, but it is important to consider how these methods and approaches have been, and might be, used in animal welfare assessment in other areas. The aim research in zoo Bojnice and of this work was to investigate assessmetn of good animal welfare in Slovak zoos in general and its implementation of assessment with a priority orientation on basic zoohygiene factors. Assessing the welfare of animals kept in zoos based on systematic and quantified monitoring of basic zoohygiene indicators is currently part of the responsible and sustainable management of a modern zoological organization. Implemented an animal welfare assessment programme in our zoo encompasses various actions and procedures. This involves assessments for different animals (or groups of animals) and includes tasks such as data collection and analysis, setting priorities, troubleshooting, forming working groups, and developing assessment templates tailored to specific individuals, species or situations. Assessed using a combination of resource-based and animal-based indices usually divided into behavioural indicators, physiological indicators and clinical/pathological signs. Assessments of primary zoohygienic factors are performed through more traditional approaches by employing direct observations and time-consuming data collection. These limitations may be overcome through automated monitoring using devices and sensors. Animal welfare is also a growing public concern that has the potential to undermine the social license of zoos and aquariums and each zoo must take into account their own option how to ensure, that all needs of the animals are met. Professional zoological institutions in the Slovak Republic absolutely need the identification and implementation of tools for assessing the welfare of animals, which enable continuous quantitative monitoring of the well-being of individual animals in an *ex-situ* environment.

Key words: *welfare assessment, quality of life, zoo animals*

Acknowledgement: Slovak University of Agriculture in Nitra - prof. Ing. Vladimír Tančin, DrSc. and prof. Ing. Milan Šimko, PhD

Contact address: Viera Madajová, Andrej Duchoň, National zoo Bojnice, Zámok a okolie 6, 972 01 Bojnice, viera.madajova@zoobojnice.sk, andrej.duchon@zoobojnice.sk

DOI: https://doi.org/10.15414/2025.9788055228310

Evaluation of the level of nutrition of polygastric protected animals reared *ex-situ*.

Andrej DUCHOŇ[1], Milan ŠIMKO[2], Viera MADAJOVÁ[1]

Supervisor: prof. Ing. Milan Šimko, PhD.

Nutrition is defined as the process of providing and obtaining the food necessary for the health and growth of animals. But good animal nutrition in zoos in general is not easy. The regulation of animal nutrition is primarily linked to the functions of the various tissues and organs of animals, but it also affects their behavior and well-being. A good nutritional effect also depends on the organization the provision of nutritional resources and the methods of their preservation. The aim of ensuring an adequate nutritional basis for feeding wild herbivores in captivity is difficult to realize in many cases, mainly because of insufficient data on the particular needs of the species. The natural diet is usually impossible to offer, especially for selective herbivores and for animal species away from their natural climatic zone. Adapting different types of conservation of browse feed designed for domestic livestock may be the one of alternatives in most cases. The aim of research in National Zoo Bojnice is to evaluate the quality and nutritional value of feed for protected animals kept in *ex-situ* conditions and determine feed with optimal nutritional value, especially for grazers and especially for biters, as a nutritional supplement of natural feed by preparing and using the fermentation of foliage of selected tree species. Ligneous plants, which may be large/small trees or shrubs, are an important component of the cellulosic and high-protein fodder resources available for use by livestock and wildlife alike. Tree foliage is being increasingly recognized as a potentially high-quality feed resource for ruminants, particularly to supply crude protein. Whilst it is well recognized that some tree foliage is palatable, digestible, and often high in protein, the detailed roles of these forages as sources of critical nutrients in forage-based diets are largely unknown. Nowadays and in the future is useful to assess the suitability of zoo feeding regimes, to improve the welfare and success of captive populations on research results. Target nutrition can help animals to cope with health problems. On the other side, incorrect nutrition could negatively affect their well-being and quality of their life.

Key words: *zoo animals, nutrition standards, browsers, grassers, fermentation*

Acknowledgement: Slovak University of Agriculture in Nitra - prof. Ing. Milan Šimko, PhD.

Contact address: [1]Andrej Duchoň, Viera Madajová, National zoo Bojnice, Zámok a okolie 6, 972 01 Bojnice, andrej.duchon@zoobojnice.sk, viera.madajova@zoobojnice.sk,
[2]Milan Šimko, Institute of Nutrition and Genomics, Faculty of agrobiology and food resources, Slovak University of Agriculture in Nitra, Trieda Andreja Hlinku 2, 949 76 Nitra, milan.simko@uniag.sk

DOI: https://doi.org/10.15414/2025.9788055228310

Effect of different straw structures on milk production and composition of dairy cows.

Mária KAPUSNIAKOVÁ, Milan ŠIMKO

Supervisor: prof. Ing. Milan Šimko, PhD.

The aim of the experiment carried out on the university farm Kolíňany - farm Oponice was to determine the effect of changing the length of straw on the milk production and content of milk components (fat; protein). The experiment was carried out for one month in a group of high producing Holstein-Friesian dairy cows, which were at the peak of their lactation (61-120 days in milk) and were divided into three groups (G1;G2;G3) where total mixed ration (TMR) was fed with different straw lengths. A dairy group of cows at the peak of their lactation 1 (G1) were fed TMR1, which consisted of straw particles 3±2 cm in length. The G2 group of dairy cows was fed TMR2 (3±2 cm; 15±2 cm) and the G3 group was fed TMR3 (15±2 cm). A TOMAHAWK Straw mill 404M was used to get the theoretical straw particle length. The structural aspect of TMR was also evaluated (Penn State Particle Separator method) during the monitoring period (3 × per monitoring period) (05:00;11:00;17:00;23:00). Milk production efficiency of dairy cows (milked 3 × daily - herringbone type) was recorded daily and then downloaded using HerdMetrix software. The True test method (at 10-day intervals) was used to monitor milk constituents (fat;protein) accurately and periodically. A significant increase in milk production was observed between G1 and G3 groups ($p<0.05$). In group G1 where TMR1 was fed, the average monthly milk production per cow was 1030.5 kg, where as in G3, when TMR3 was fed, it increased to 1130.7 kg representing a difference in monthly milk production of 100.2 kg ($p<0.05$, p-value=0.000). The increase in milk production was probably influenced by selecting dairy cows mainly in favour of finer particles (pad), which contain the starch (energy) component of the ration ($p<0.05$). When analysing the content of milk components (fat;protein), there were statistically significant differences between the dairy cow groups ($p<0.05$). Between dairy cows in groups G1 and G2 was a statistical increase in milk fat content of 0.26% ($p<0.05$). Comparison of fat content between cows in the G2 and G3 groups was not statistically significant increase ($p>0.05$). When milk protein content was evaluated, there was a significant difference in each group (G1-G3) ($p<0.05$, p-value=0.000). Difference in milk protein content between the G1 and G2 group of dairy cows represented an increase of 0.07% ($p<0.05$) and with the G3 group of dairy cows represented an increase of 0.25% ($p<0.05$). Based on the results, it was found that changes in straw particle length can lead to an increase in milk production and quality.

Key words: *dairy cows, milk production, milk quality, straw particles*

Acknowledgement: This work was supported by the Scientific Grant Agency of the Ministry of Education, Science, Research and Sport of the Slovak Republic and the Slovak Academy of Sciences, project no. 1/0321/23 (Effective management of the ruminant nutrition using a modern monitoring of the internal environment).

Contact address: Mária Kapusniaková, Milan Šimko, Institute of Nutrition and Genomics, Faculty of agrobiology and food resources, Slovak University of Agriculture in Nitra, Trieda Andreja Hlinku 2, 949 76 Nitra, xkapusniakov@uniag.sk, milan.simko@uniag.sk

DOI: https://doi.org/10.15414/2025.9788055228310

SECTION

Multifunctional Agriculture, Environment, Landscape Architecture and Rural Development

DOI: https://doi.org/10.15414/2025.9788055228310

Assessment of flower-visiting communities in alfalfa fields using volatile-baited traps

Aletta ŐSZ[1], Sándor KOCZOR[2], István SZARUKÁN[1], Szabolcs SZANYI[1], Dóra ARNÓCZKYNÉ JAKAB[1], Nagy ANTAL[1]

Insect pollination is essential for approximately 80% of European plant species. While the flower-visiting behavior and pollination roles of honeybees and bumblebees are well-documented, other taxa remain underexplored in this context. Our research investigated flower-visitor assemblages in agricultural habitats, specifically in five old alfalfa fields located in Eastern Hungary. Between 2019 and 2022, for sampling CSALOMON® VARL+ funnel traps baited with feeding attractants (compounds of flower scents).
During the study, we collected 28,161 individuals representing 115 species across seven insect orders (Coleoptera, Diptera, Hemiptera, Hymenoptera, Lepidoptera, Mecoptera, Neuroptera, and Orthoptera). The most abundant species were from the Lepidoptera (*Diachrysia chrysitis*, *Hypena proboscidalis, Hoplodrina ambigua, Sitotroga cerealella*), Hymenoptera (*Apis mellifera*), and Hemiptera (*Lygus rugulipennis*) orders.
Our findings contribute new data on the flower-visiting insect assemblages in alfalfa fields, particularly regarding the lesser-known floriphilic and floriphagous groups, such as nocturnal lepidopterans and plant bugs (Heteroptera).

The current research was partially financed by the National Research, Development and Innovation Office (NKFIH, grant FK134744)

Contact address: [1] Faculty of Agricultural and Food Sciences and Environmental Management, Institute of Plant Protection, University of Debrecen, Debrecen, Hungary
[2] Department of Chemical Ecology, Plant Protection Institute, HUN-REN Centre for Agricultural Research, Budapest, Hungary

DOI: https://doi.org/10.15414/2025.9788055228310

Artist as connecting medium of art and spaces in abeyance

Eva BODÓ, Roberta ŠTĚPÁNKOVÁ

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

In last few years, artists expanded their activities to spaces outside their studios to break the boundaries of arts they engaged in with a direct confrontation of their works on the location. The new environments: may it be part of the street, hidden spot between two buildings or even a 'left-alone' object in abeyance until further notice, provided diversity on resources, access to wide range of activities, a direct connection with the locations and dialogues emerging from these activities on site, which would/could not happen within gallery spaces. Naturally, questions popping up during these engagements needed immediate attention and decision making. Shall the created artwork be only a temporary object disturbing the plain space or shall it immerse onto the space itself as its natural component? Is the object viewed as artwork only, or shall it also provide, or better said, provoke as a transmitter of concrete sensitive topic? Shall it reflect more on aesthetics with active audience engagement, or to be presented as untouchable 'high art'? Most of the initiatives included these questions into the creative process and by use of different media, artists were able to present works suitable for the location and in interest of inhabitants. These were either site specific objects, sculptures, temporary visual projections on the existing blocks, or short performances narrowed down onto few time lapses.
However, these activities were focusing more on the artwork and artists activities instead of dealing with the space as part of artwork itself. It does not mean that positioning an artwork onto the space does not change the initial aim of the space it serves for, it changes immediately. But there is more to that. To understand and be able to locate an object, either immersive or 'stand-alone', it is necessary to document the location first. To make a proper research on structures, connections, material, views from different angles or even lead dialogues with inhabitants about pros and cons of the given space. To look for the history for reference, dig into the ownership statuses, find answers how that space came to life or what was the cause of that vague terrain. The variety of media {photography, printmaking, sketching or digitalizing of views} secures proper mapping and serve as fundamentals to raise public awareness of the issue, which is overseeing of the need of reactivation of urban voids and ignorance of rising number of abandoned spaces within the city and its surrounding areas.

Key words: *urban voids, public spaces, environment, abeyance, artwork, audience, provocation.*

Contact address: Mgr.art Eva Bodó, Slovak University of Agriculture in Nitra, Faculty of Horticulture and Landscape Engineering, Institute of Landscape Architecture, Tulipánová 7, 949 76 Nitra, Slovakia
xbodoova@uniag.sk

DOI: https://doi.org/10.15414/2025.9788055228310

Accessibility and Proximity of Urban Green Spaces to Housing Estates in Nitra

Zuzana VINCZEOVÁ, Attila TÓTH

Supervisor: doc. Ing. Attila Tóth, PhD.

As urbanization is rapidly increasing and cities are becoming densely populated, the inclusion of green infrastructure—such as parks, gardens, tree-lined streets or communal green spaces—within residential neighborhoods is becoming more and more important. Urban green spaces provide essential environmental services, including reducing air pollution, regulating temperatures by mitigating the urban heath island effect and managing stormwater through natural filtration processes. Furthermore, they contribute to enhancing urban biodiversity and promoting ecological resilience within urban ecosystems. The proximity and accessibility of green spaces to housing estates significantly influence the quality of life for urban residents. Urban green spaces located within walking distance of housing estates provide residents with convenient access to areas for exercise, leisure and social engagement, which have a positive impact on both physical and mental health. This paper explores the significance of proximity and walking distance to urban green spaces from residential areas, arguing that the overall accessibility and quality of these spaces are more impactful than their sheer quantity in enhancing the quality of urban life. While the quantity of green spaces in a city may seem important, this research emphasizes that proximity and ease of access are the primary drivers of green space utilization and the associated benefits for residents. People are more likely to use urban green spaces when they are conveniently located near residential areas, particularly within a 5–10-minute walk. The city of Nitra offers five larger parks in addition to urban green spaces that are part of residential neighborhoods. The comprehensive analysis is based on the walking distance and accessibility of the selected areas to residential zones in the city of Nitra. The main method used for the selected areas consists of the recommended standards of the Vienna manual "STEP2025". These standards were applied to these specific areas and the result of the analysis was an accessibility map. This paper concludes that urban planners and landscape architects should prioritize the strategic placement of green spaces within close proximity to housing estates, ensuring that they are easily accessible for all residents. By prioritizing proximity and walkability, urban planning can maximize the social, environmental and economic benefits of urban green spaces, ultimately contributing to healthier, more livable and more sustainable urban environments.

Keywords: *green infrastructure, urban green spaces, accessibility, housing estates, landscape architecture*

Acknowledgement: This paper builds upon the dissertation 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, xvinczeovaz@uniag.sk, doc. Ing. Attila Tóth, PhD., attila.toth@uniag.sk, Institute of Landscape Architecture, FHLE, SUA Nitra, Tulipánová 7, 949 76 Nitra, Slovakia

DOI: https://doi.org/10.15414/2025.9788055228310

Long-term effect of biochar and biochar reapplication on soil emissions (N_2O), temperature, and soil water content in May, June, and July of 2020 and 2024

Melinda MOLNÁROVÁ, Ján HORÁK

Supervisor: doc. Ing. Ján Horák, PhD.

Since the industrial revolution, greenhouse gas emissions from human activities have been the primary cause of climate change. Land use and agriculture are among the major sectors responsible for the production of greenhouse gases. Due to population growth and increased demand for food production, the use of nitrogen fertilizers has risen, leading to higher emissions of greenhouse gases such as nitrous oxide (N_2O). The aim of the field experiment, which has been ongoing in Dolná Malanta since 2014, is to determine how biochar affects soil properties. In 2014, biochar was applied at rates of 10 and 20 t/ha (B10, B20) to all plots except for the control plots (B0N0, B0N1, B0N2). In 2018, biochar was reapplied at the same rates to only one half of the original biochar plots (reapB10, reapB20). This experiment includes three levels of nitrogen fertilization (N0, N1, and N2) combined with control (B0) and biochar treatments. The level of fertilization varied depending on the crop (*Pisum sativum* L.) grown during the study period in May - July of 2020 and 2024. Soil air samples were collected twice a month from May to July in 2020 and 2024 using the closed chamber method. Disturbed soil samples were taken at a depth of 0–0.1 m during gas sampling events to estimate soil water content (SWC) using the gravimetric method. At the same time, soil temperature was measured at a depth of 0.05 m using a thermometer. The application and reapplication of biochar at both levels (10 and 20 t/ha) increased SWC in both years compared to control treatments without biochar (B0N0, B0N1, B0N2). The greatest effect was observed in the treatments reapB10N2 and reapB20N2. A significant difference ($P < 0.05$) was found in June 2024 in treatments B20N0 and B10N0. Additionally, a significant difference ($P < 0.05$) was found in June 2024 at the first level of N-fertilization, specifically in the treatments reapB20N1 and B10N1, respectively. Soil temperature increased in all treatments compared to their respective controls (B0N0, B0N1, B0N2) in 2020, but in 2024, soil temperature increases were observed only in treatments with the second level of N-fertilization compared to the control (B0N2). However, no statistically significant differences ($P < 0.05$) in soil temperature were found between treatments. Soil emissions of N_2O generally decreased in all treatments, with the greatest reduction observed in treatments with biochar reapplication compared to the control treatments (B0N0, B0N1, B0N2) in 2020. Significant differences ($P < 0.05$) were found in May in the B10N2, B20N2, and reapB20N2 treatments compared to the control (B0N2). A significant difference ($P < 0.05$) was also found in June between treatments reapB10N1 and B20N1. In 2024, soil emissions of N_2O decreased in all treatments compared to the respective controls (B0N0, B0N1, B0N2). In May 2024, significant differences ($P < 0.05$) were observed in the B10N1, B20N1, and reapB10N1 treatments compared to the control (B0N1). In June 2024, treatment B10N0 showed a significant difference ($P < 0.05$) compared to the control (B0N0) and to treatments reapB10N0 and reapB20N0. In conclusion, biochar reapplication had the greatest effect on decreasing soil emissions of N_2O, increasing SWC, and increasing soil temperature. Integrating biochar into soil management practices is a potential alternative for mitigating climate change and improving soil health.

Key words: *biochar, field experiment, N-fertilization, reapplication, soil water content*

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, doc. Ing. Ján Horák, PhD., Institute of Landscape Engineering, Slovak University of Agriculture in Nitra, Hospodárska 7, 949 76 Nitra, Slovakia, xmolnarova@uniag.sk, jan.horak@uniag.sk

DOI: https://doi.org/10.15414/2025.9788055228310

Modeling flood risk mitigation potential using green infrastructure in Trebišov, Slovakia

Kostiantyn SOKOLCHUK

Supervisor: doc. Ing. Marek Sokáč, PhD.

This paper describes part of the results of modelling water flows in the combined sewerage system of Trebišov, Slovakia. The aim of the work was to assess the risk of flooding in the urban area and to reduce it with the help of Green Infrastructure (GI). The study was carried out using MIKE+, a comprehensive software for hydraulic and hydrological modelling. QGIS was used for additional analysis and visualisation. Using a model of the urban sewerage system, water runoff was modelled using short-term block rainfall events of varying intensity, lasting from 15 to 120 minutes and with a return period of 2 to 10 years. For each scenario, the number of flooded manholes and the estimated volume of water that would spill onto the streets when sewer shafts overflow were determined. In order to model the ways to mitigate the effects of flooding, areas with the potential for the installation of green infrastructure (GI) were identified and included in the hydrological model of surface runoff. Two types of GI were considered in this study: permeable pavements and green roofs. The stormwater runoff was modelled under four scenarios: current condition, implementation of permeable pavements, green roofs and a combination of the two. The modelling results were compared with the current conditions. It was found that the use of both types of GI can potentially reduce the number of flooded points by more than 30% for short-term rainfall events with a two year frequency of occurrence. At the same time, the volume of water above the ground will decrease by more than 70%, and in the case of 120-minute rainfall, by more than 80%. As the return period of short-term rainfall increases, the number of flooded points decreases to an average of 5%. However, the use of green infrastructure will reduce the total amount of water above ground by more than 40%, even in the case of rainfall with a recurrence period of 10 years. If we consider the effectiveness of each GI type separately, with used parameters, permeable pavement proves to be more effective. In some cases, green roofs have even shown a slight increase in the volume of water above the ground, an analysis of which requires further research. However, in combination, these tools propose significant potential for the implementation of green roofs in the city in the context of stormwater management, especially in the context of climate change.

Keywords: *green infrastructure, urban drainage, climate change, adaptation measures, surface flooding*

Acknowledgement: The authors would like to thank Východoslovenská vodárenská spoločnosť, a.s. (VVS, a.s., East Slovak Water Utility, JSCo.) for providing data for this study and to DHI Slovakia, Ltd., for provided opportunity to use MIKE + software for the research.

Contact address: Kostiantyn Sokolchuk, IH SAS; Dúbravská cesta 9; kostia.socholchuk@gmail.com

DOI: https://doi.org/10.15414/2025.9788055228310

Assessment of Climate Change Impacts in Slovakia

Ing. Ivana DOBIAŠOVÁ, Ing. Martin MINÁRIK

Supervisor: Assoc. doc. Ing. Ján Čimo, PhD.

Climate change significantly influences agriculture in Slovakia. Climate changes affect the amount and distribution of precipitation, temperature, the length of the growing season, and other factors that impact the production of agricultural crops and the breeding of livestock. Common manifestations include drought, increased precipitation intensity, higher summer temperatures, and an increase in pests, which multiply more rapidly due to rising temperatures and changing moisture levels. It is important to recognize the significance of climate change and its impact on agriculture and take steps to mitigate its negative effects. This may involve supporting sustainable agriculture adapted to new climatic conditions and reducing the environmental impact. With the assumption of increasing average yields (based on increasing average temperature), the expansion of areas for growing individual crops into higher elevations of Slovakia can also be expected. However, this is also associated with suitability or unsuitability for crop cultivation in terms of soil requirements. The risk of late frosts threatening agricultural crops may be associated with the lengthening of the growing season. Phenophases are phases in the life of plants related to their growth, flowering, and fruit production. Changes in these phenophases can be significant indicators of climate change. The impact of climate change on plant phenophases also affects agriculture. Earlier plant phenophases can influence the timing of sowing and harvesting, which can impact overall crop production. To address our issue, meteorological data for the reference period from 1961 to 2020 were provided by the Slovak Hydrometeorological Institute in Bratislava. Subsequently, the onset (in spring) and end (in autumn) of the growing season were calculated: the large growing season, defined by the onset and end of days with an average daily temperature $T \geq 5.0$ °C, and the main growing season, defined by the onset and end of days with an average daily temperature $T \geq 10.0$ °C. Forecasts for the decades 2011-2020, 2041-2050, 2071-2080, and 2091-2100 were then prepared in the form of map outputs. For processing the map outputs, we chose the ArcGIS Pro software from ESRI. The data on the lengths of the growing seasons were prepared in MS Excel and then assigned to the individual 100 meteorological stations across Slovakia. The resulting map set shows changes in the lengths of the growing seasons in Slovakia for the horizons of 2041 – 2050, 2071 – 2080, and 2091 – 2100. The results of the forecasts for the development up to the horizon of 2090-2100, compared to the decade 1971-1980 (the coldest decade), indicate that the growing season in the Danube Lowland will extend by an average of 25-30 days. This trend may pose a significant problem for the cultivation of native plant species in the future. It is crucial to monitor changes in phenological phases and adapt to new conditions. Additionally, it is important to recognize the significance of climate change and its impact on our environment, and to take measures to mitigate its negative consequences.

Key words: *climate change, phenophases, growing season, agriculture*

Contact address: Ivana Dobiašová, Institute of landscape engineering, Slovak University of Agriculture in Nitra, email: xdobiasovai@uniag.sk

DOI: https://doi.org/10.15414/2025.9788055228310

Growth medium effect on *Scenedesmus obliquus* biomass production

Marta LENARTOWICZ, Ľuboš JURÍK

Supervisor: prof. Ing. Ľuboš Jurík, PhD.

Optimizing biomass growth in various media is essential for advancing algal-based applications, including future wastewater treatment. This study investigated the growth performance of *Scenedesmus obliquus* in different media, including those enriched with phosphorus and nitrogen, to understand how these nutrients influence algal biomass production. In this experiment, 2.5 mL of *S. obliquus* culture with an initial cell concentration of approximately 340 mg/L was added to 100 mL of the following media: (1) deionized water (dH_2O), (2) freshwater from Šindolka spring (FW), (3) Bristol medium (BM), (4) Bristol medium with additional phosphorus (0.1 mM K_2HPO_4) (BM+P), and (5) Bristol medium with additional nitrogen (0.1 mM NH_4NO_3) (BM+N). Algae were cultured under controlled conditions of light and temperature for 10 days. The biomass concentration (mg/L) was measured indirectly by the absorbance of the cell suspension at $\lambda = 560$ nm. A calibration curve was established for A560 and dry weight (DW) before measurements. Absorbance was measured daily in triplicate for each medium. Specific growth rate (GR) and volumetric biomass productivity (VBP) were calculated based on dry weight. The results indicated that the fastest growth occurred in BM, BM+P, and BM+N, where absorbance increased from ~0.22 to ~1.6 over 10 days, signifying a dynamic logarithmic phase. FW showed similar growth patterns, reaching values of ~1.13, suggesting logarithmic growth but at a slower rate compared to BM, BM+P, and BM+N. In dH_2O, algae initially exhibited slow growth, peaking at an absorbance of ~0.715 on day nine but subsequently declining to ~0.618, indicating the onset of the decline phase. Dry weight was highest in the medium with phosphorus (1815.4 mg/L), whereas in dH_2O, it only reached 805.1 mg/L. The maximum volumetric biomass productivities were 148.1 mg/L/day (day 9), 149.4 mg/L/day (day 9), and 141.3 mg/L/day (day 8) for BM, BM+P, and BM+N, respectively. The highest growth rates of 180.0 mg/L/day (day 8), 180.1 mg/L/day (day 7), and 193.2 mg/L/day (day 7) were recorded for BM+N, BM+P, and BM. Growth in BM ($R^2 = 0.9812$), BM+P ($R^2 = 0.9809$), and BM+N ($R^2 = 0.9782$) closely followed a linear pattern compared to dH_2O and FW. Enriching the medium with phosphorus and nitrogen significantly enhanced *S. obliquus* biomass production, suggesting that these nutrients promote faster growth and higher biomass yields. These results indicate that *S. obliquus* could be effectively used in nutrient-rich environments, such as dairy wastewater, to remove excess phosphorus and nitrogen while producing valuable biomass. This approach offers a dual benefit for future wastewater treatment applications by addressing nutrient pollution and generating biomass for potential use in biofertilizers.

Key words: *Scenedesmus obliquus, biomass growth, phosphorus, nitrogen, algal biomass*

Acknowledgement: Work was supported by NENUPHAR project (ID 101082169: New governance models to enhance nutrient pollution handling and nutrients recycling).

Contact: Marta Lenartowicz, Slovak University of Agriculture in Nitra, Hospodárska 7, 949 76 Nitra, Slovakia, lenartowiczm@uniag.sk

Application of Computer Modeling and Visualization in the Restoration Process of a Rural Street in the Village of Dražovce

Donat KARZHAUOV

Supervisor: prof. Ing. Viera Paganová, PhD.

The current market offers a wide range of technologies and software solutions for the collection and processing of spatial data. Each of these technologies is characterized by a different approach, output quality, time and financial requirements, and users' skill demands. Therefore, it is crucial for landscape architects to choose an optimal solution that meets their needs and budget. In the past, professional tools were associated with higher costs and better outputs. However, with the development of modern technologies and open-source software, new opportunities for acquiring spatial data using commonly available devices such as smartphones, action cameras, and drones have emerged. This study focuses on examining and comparing various types of spatial data acquisition, emphasizing their cost, time, and qualitative efficiency. The goal is to generate a point cloud model of the current geometric state of a rural street, which will serve as a basis for its redesign. An important aspect is the use of maximally accessible software solutions, whether open-source or free of charge, and readily available devices. In this study terrestrial laser scanning (TLS) served as a benchmark for accuracy. Aerial photogrammetry proved to be the most suitable acquisition method from the perspective of speed, accessibility, cost, and accuracy for landscape architecture purposes. Close-range photogrammetry proved to be a useful supplement for drone-based data acquisition. The developed methodology effectively streamlined the analysis process and enhanced the quality of design outputs, including visualizations, for the renovation of the rural street. The acquired 3D data, after being imported into the CAD software, served as a foundation for modelling the proposed design. The accurate 3D model enabled the optimization of furniture placement, sidewalks, greenery, and other elements within the context of the existing buildings and vegetation. This knowledge and practical experience utilizing modern technologies and open-source software facilitated a successful renovation and revitalization of the linear public space, ultimately improving its functionality and safety for residents.

Keywords*:* *Laser scanning, photogrammetry, visualization, open source, landscape architecture, rural street*

Contact address: Ing. Donat Karzhauov, Slovak University of Agriculture in Nitra, Faculty of Horticulture and Landscape Engineering, Institute of Landscape Architecture, Tulipánová 7, 949 76 Nitra, Slovakia xkarzhauov@uniag.sk

DOI: https://doi.org/10.15414/2025.9788055228310

Lost Spaces Reimagined: The Human Impact of Urban Green Infrastructure

Tímea ŽOLOBANIČOVÁ, Roberta ŠTĚPÁNKOVÁ

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

In contemporary world, characterised by intensive urbanisation and growing environmental challenges, it is becoming increasingly important to find new ways for sustainable urban development. While modern urban planning focuses on large-scale projects and large green spaces, there is hidden potential in many historic places in the form of forgotten gaps. These often-overlooked places, which belong to urban planning but have lost their function, offer unique opportunities for developing the character of a place, engaging the community, revealing art or can contribute to the adaptation of the environment to climate change. In these 'lost green' places that the potential for transforming urban gaps. Unlike large green spaces, which are often designed from scratch, bringing a new function to the gaps requires a sensitive approach to existing structures and materials that carry the history and identity of a place. This paper focuses on the analysis of the potential of these historic culverts for sustainable urban development. Through examples and concepts that highlight the diverse possibilities of using forgotten spaces, we want to extend the concept of bring back functioncition and move it to a new dimension that respects and integrates the historical heritage of urban environments that have become overgrown with unorganized green spaces over the years. Our findings suggest that historic alcoves can serve as pivotal elements in the transformation of cities into sustainable and resilient urban environments, especially within the historical city centre. The research emphasises respect for the historical identity of the space and uses modular solutions for adaptable and dynamic use. The aim is to strengthen the awareness of 'indeterminate green space' and to highlight its key role in the sustainable transformation of urban environments.

Keywords: urban green, lost spaces, public space, sustainability, public greenery

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

DOI: https://doi.org/10.15414/2025.9788055228310

Comparison of NDGI and Water Potential Measurements for Non-Invasive Assessment of Leaf Water Status in Walnut Trees.

Oliver OBROČNÍK, Viliam BÁREK

Supervisor: prof. Ing. Viliam Bárek, CSc.

In our study, we compared the differences in NDGI values, between the top and bottom part of the leaf (modified NDGI), with the measured water potential values. NDGI is a semi-analytical index deduced based on the linear spectral mixture model and the spectral characteristics of vegetation, snow, soil, and dry grass. The NDGI was measured using the N-pen device, which is a small hand-held device that is attached to the leaf by a sensor on the top side and a white reflective material is attached to the underside of the leaf, perpendicular to the sensor, which is also used in the calibration of the device. The N-pen then evaluates the reflectivity at 565nm and 760nm wavelengths from which it produces the NDGI values. As the light beam passes transversely through the leaf, the thickness of the leaf influences the NDGI values to some extent. If we measure the reflectance at both the top and bottom and subtract them from each other, the resulting value is partially correlated with the thickness of the leaf, which is largely influenced by the water content of the leaf. According to this relationship we can estimate the water status of the plant. Finally, we compared modified NDGI (mNDGI) values with the results of the water potential measurements we obtained using the leaf pressure chamber. The experiment took place between July 8 and July 24, 2024, in a walnut orchard in Nové Zámky. Measurements were conducted on five trees, with NDGI values averaged from 6 leaves per tree, and water potential values averaged from three leaves per tree. The results revealed inverse correlation between mNDGI of the leaf and water potential. As value of mNDGI increased, indicating higher leaf water content, water potential values decreased, reflecting reduced water stress. For example, on July 10, mNDGI increased by 0.12%, while water potential dropped by 8.33%. This trend continued on July 11, where mNDGI increased by 2.12%, and water potential decreased by 13.64%. In contrast, on July 12, mNDGI dropped by 7.29%, while water potential increased by 1.75%, showing lower water content in the leaves. These fluctuations were consistent, with mNDGI decreases on July 16, 18, and 22, alongside rising water potential values. By July 24, a slight recovery in mNDGI (0.51%) corresponded with an 8.33% drop in water potential. This consistent inverse relationship suggests that mNDGI is able to estimate leaf water status non-invasively. mNDGI could therefore serve as a useful tool in precision agriculture, enabling rapid and non-destructive monitoring of plant water content to optimize irrigation and reduce water stress.

Key words: *NDGI, Water potential, Leaf water status, Walnut trees, N-pen, Non-invasive measurement*

Acknowledgement: The research was partially supported by the Slovak Research and Development Agency under the contracts No. APVV-20-0071 and the Slovak Grant Agency (VEGA) projects no. 1/0300/22.

Contact address: Ing. Oliver Obročník, Hospodárska 7, Nitra (Slovakia), oliverobrocnik@gmail.com

DOI: https://doi.org/10.15414/2025.9788055228310

SECTION

Biotechnology, Applied and Molecular Biology

DOI: https://doi.org/10.15414/2025.9788055228310

Effectiveness of the remotely delivered weight loss intervention using Whole Food Plant-based Diet

Radek LÁTAL

Supervisor: prof. Ing. Marta Habánová, PhD.

In 2019, 58.7% of adults in Slovakia were classified as overweight or obese, representing a significant increase from previous decades. Overweight and obesity are major risk factors for developing serious non-communicable diseases, including cardiovascular diseases and certain cancers. The primary cause of this trend is an increase in energy intake, driven by the widespread availability of high-calorie, nutritionally poor foods. A Whole Food Plant-Based Diet (WFPBD) has been shown to be an effective strategy for achieving sustainable weight loss due to its low energy density, even when consumed *ad libitum*. A WFPBD emphasizes the consumption of whole, unprocessed plant foods while minimizing the intake of animal products and processed foods. Community-based interventions that combine WFPBD with social support through in-person group meetings have been particularly successful in achieving long-term weight loss. However, the COVID-19 pandemic has highlighted the limitations of in-person meetings, underscoring the need for research into remotely delivered group interventions using WFPBD, an area that remains underexplored. The aim of this study was to investigate whether comparable results could be achieved with a remotely delivered intervention. This study examines the results from the five-week long remotely delivered intervention focused on weight loss through a WFPBD. Overweight or obese women (n = 17), aged 32 to 53, participated in the intervention, which included structured group calls, engagement in a dedicated Facebook group, and WFPBD diet plans. Participant assessments were conducted at both the beginning and conclusion of the five-week intervention using the InBody 970 body composition analyser. Of the 17 participants, 16 completed the intervention and attended the final evaluation, with all 16 successfully achieving weight loss. The average weight loss over the 5-week period was 5.18 kg ($P < 0.001$), with 3.83 kg attributed to fat mass and 1.34 kg to fat-free mass. The average BMI decreased from 31.54 to 29.75, representing a reduction of 5.69%. The findings of this study suggest that a remotely delivered WFPBD intervention is effective in promoting significant weight loss among overweight and obese women. These outcomes support the potential of WFPBD-based remote interventions as a scalable option for addressing obesity in situations where in-person meetings are not feasible.

Key words*: whole food plant-based diet, weight loss intervention*

Acknowledgement: This work was supported by the Operational Programme Integrated Infrastructure for the project: Long-term strategic research of prevention, intervention and mechanisms of obesity and its comorbidities, IMTS: 313011V344, co-financed by the European Regional Development Fund.

Contact address: Ing. Radek Látal, DiS., xlatal@uniag.sk; Prof. Ing. Marta Habánová, Ph.D., Institute of Nutrition and Genomics on Faculty of Agrobiology and Food Resources of Slovak University of Agriculture in Nitra, Tr. A. Hlinku 2, 94976 Nitra, Slovakia, marta.habanova@uniag.sk

DOI: https://doi.org/10.15414/2025.9788055228310

Challenges in molecular identification of the genus *Betula* (*Betulaceae*)

Lucia KLONGOVÁ, Jana ŽIAROVSKÁ

Supervisor: prof. PaedDr. Ing. Jana Žiarovská, PhD.

Molecular identification techniques are crucial for the accurate classification and understanding of plant biodiversity. Our study focuses on the potential for interspecies differentiation within the *Betula* genus. The *Betula* genus is characterized by a high hybridization potential and allopolyploidy, which presents a challenge in molecular identification. Traditional taxonomic methods often fall short due to genetic changes between species, complicating their accurate identification. Therefore, advanced molecular tools are necessary to distinguish closely related species. In this study, we used the PCR-RFLP (Restriction Fragment Length Polymorphism) molecular technique to identify birch species, including *Betula pubescens*, *Betula papyrifera*, and *Betula pendula*. This technique is highly reproducible and effective in detecting species-specific genetic profiles. Through *in silico* analysis, we targeted the *adh* gene, known for its polymorphisms between these species, and identified restriction sites that generate distinct profiles for each species. The study utilized *adh* gene sequences from the GenBank database, applying tools such as BLAST for sequence alignment and NEBCutter for predicting restriction sites. Laboratory analyses confirmed the amplification of the *adh* gene across all sampled birch species; however, bioinformatic data are limited, complicating the prediction of precise primer binding sites for *Betula papyrifera* and *Betula pubescens*. We propose sequencing the amplified products to improve primer design and increase accuracy in interspecies differentiation. Preliminary results suggest that while molecular markers such as the adh gene may help distinguish some species, the high genetic similarity and potential introgression between *Betula* species complicates their identification.

Key words: *Betula, molecular identification, interspecies differentiation, in silico, RFLP*

Acknowledgement: Work was supported by the Operational programm Integrated Infrastructure within the project: Demand-driven research for the sustainable and inovative food, Drive4SIFood 313011V336, cofinanced by the European Regional Development Fund and APVV-20-0058 The potential of the essential oils from aromatic plants for medical use and food preservation.

Contact address: Lucia Klongová, Research Centre AgroBioTech, Slovak University of Agriculture in Nitra, email: lucia.klongova@uniag.sk

DOI: https://doi.org/10.15414/2025.9788055228310

Near infrared image analysis of plant development

Gyula PINCZÉS, Sabir HAIDER, Eunika GAYDAROVA, Viktória BAKSA, Gáspár BÁNFALVI

Supervisor: Dr. Gábor Szemán-Nagy

The main goal of our research is to digitally map the germination dynamics of agriculturally relevant model organisms, maize (*Zea mays* L.), the world's largest crop. Instruments using near-infrared light (NIR) were developed by our research team. In a series of experiments, biomass growth was characterized by the areas mapped on the images. For the purpose of generating numerical data, the covered areas were expressed in pixels. The germination dynamics grown in dark and NIR-light-grown plants are identical, with germination initiation generally taking 3.7 ± 0.4 days. We have shown that near infrared radiation does not affect the timing of germination. With this series of experiments, we have established an assay system that is suitable for processing large numbers of samples in a cost-effective manner. Our work has shown that the maize growing time are proportional to the length of germination time, which is a unique characteristic of the hybrids, e.g. H1 - Ivola, 350 FAO number, 1.675 day germination time; H2 - Lactosil, 460 FAO number, 3.363 days germination time. Our studies also included the effect of certain metal ions on the germination time of maize along a concentration gradient. We observed that NaCl postpones the onset of germination by 6.708 days at a concentration of 7.1 g/L compared to the unset of control of 3.728 days germination time, and $MgCl_2$ postpones the onset of germination by 5.652 days at a concentration of 7.457 g/L compared to the control of 3.785 days germination time. Thus, the difference in the start of germination was 2.98 days for NaCl and 1.867 day for $MgCl_2$. Considering that using our system, we do not have to wait until the end of the growing season to draw conclusions, we can facilitate the development of agro-plant biology studies in maize we can do it in-vitro.

Keywords: *Zea mays* L.*, near infrared light (NIR), image analysis, germination, metal ions*

Acknowledgement: Work was supported by University of Debrecen, Faculty of Agricultural and Food Sciences and Environmental Management, Kálmán Kerpely Doctoral School of Crop Sciences and Horticulture; Faculty of Science and Technology, Department of Molecular Biotechnology and Microbiology

Contact address: Gyula, Pinczés, Hungary, University of Debrecen, Department of Molecular Biotechnology and Microbiology, 4032 Debrecen Egyetem tér 1., e-mail: pigyu007@gmail.com

DOI: https://doi.org/10.15414/2025.9788055228310

Pollen germination of millet (*Panicum miliaceum*) after the application of titanium and zinc nanoparticles

Lenka TOMOVIČOVÁ

Supervisor: doc. Ing. Ľuba Ďurišová, PhD.

Millet (*Panicum miliaceum*) is one of the six major cultivated cereals of the world. It is characterised by its resistance to heat and drought. It grows in hot, arid and semi-arid areas. The main importance of millet lies in the fact that it is grown as animal fodder, which proves that it has an important place in agriculture. A current trend in agriculture is the use of nanoparticle-based products, which are used as micronutrients or plant growth promoters. Zinc nanoparticles have a positive effect on the germination, growth and yield of millet. Titanium nanoparticles improve plant growth and development as well as photosynthesis. Vital pollen grains are essential for successful fertilisation and fruit development. The aim of our research was to investigate the effect of zinc and titanium nanoparticles on the germination of millet. We applied three different concentrations of zinc (Zn-NPs) and titanium (Ti-NPs) nanoparticles at 1.4; 14 and 140 mg/L. Pollen germination was performed under *in vitro* conditions using agar medium. The germination percentage was evaluated by standard methods after twenty-four hours. The highest germination was observed for both titanium and zinc, identically at a concentration of 1.4 mg/L. Pollen germination decreased with increasing concentration, although it was higher compared to the control except for the highest zinc concentration. The low germination values achieved are probably due to the composition of the culture medium, which will need to be enriched with additional nutrients.

Key words: *millet, zinc nanoparticles, titanium nanoparticles, pollen germination*

Acknowledgement: This publication was funded by the Grant Agency of the Slovak University of Agriculture (GA SPU), project No 13-GA-SPU-2024 and supported by the Slovakia's recovery and resilience plan, project No. 09I03-03-V05-00018 – Early Stage Grants at SUA in Nitra.

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

DOI: https://doi.org/10.15414/2025.9788055228310

Effect of bisphenol S on HUVEC viability parameters and IL-6 production

Denis BAŽÁNY, Hana GREIFOVÁ, Norbert LUKÁČ

Supervisor: prof. Ing. Norbert Lukáč, PhD.

The ubiquitous prevalence of long-lasting and practically useful endocrine disruptors has drawn attention from the scientific community in recent years. Substances that have a tendency to inhibit or substitute hormones and their receptors fall under this category. The activity of bisphenol S was the main focus of our studies. This compound is one of the primary alternatives to bisphenol A, whose usage in industrial applications is becoming less common. The usage of these compounds in so many various products is potentially the largest issue. Thermal paper, cans, and different types of plastic packaging are examples of BP´s industrial uses. Bisphenols can be found in drinking water, soil, and other parts of the human environment at elevated concentrations. Our main goal was to determine how bisphenol S affected the inflammatory process, which is a common and unavoidable part of non-specific immunity. As a laboratory model, we used human umbilical vein endothelial cells (HUVEC) which is most suitable laboratory model for study of inflammatory process. Cells were cultured according to standard protocols. After reaching the desired confluence, we cultured them with the addition of different concentrations (0.05; 0.1; 1; 10; 25; 50 μM) of bisphenol S for 24 hours. We used Zymosan as positive control to induce the inflammatory process. After 24 hours of incubation, we conducted a lysosomal activity assay (Neutral Red), and we also measured IL-6 production by using the ELISA method. The Neutral red assay's results revealed no significant variations in lysosomal activity between the treatment groups. Significantly higher values were observed for IL-6 production at concentrations of 0.1 μM ($P \leq 0.01$), 1 μM ($P \leq 0.001$), 10 μM ($P \leq 0.001$), and 25 μM ($P \leq 0.01$). The results of the submitted study indicated that BPS was not harmful for lysosomal activity at the tested doses. Nevertheless, we also verified that BPS stimulated the production of the pro-inflammatory cytokine IL-6. To fully comprehend the relationships between BPS and inflammatory processes, more research is required.

Key words: *Bisphenol S, Inflammation, Viability, HUVEC*

Acknowledgement: This work was financially supported by grants: APVV-20-0218 and VEGA No. 1/0207/23

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

DOI: https://doi.org/10.15414/2025.9788055228310

Evaluation of potential reprotoxicity of acetamiprid *in vitro*

Lucia ZUŠČÍKOVÁ

Supervisor: Ing. Tomáš Jambor, PhD.

Plasticisers such as Bis-(2-ethylhexyl)phtalate (DEHP) are commonly used to make poly(vinyl chloride) (PVC) pliable and supple. DEHP is a synthetic chemical that is frequently added to plastics that are used in food packaging, medical equipment, and many other commercial and industrial items. Food, water, and indoor air all contain loosely bound DEHP that is discharged from its substrates into the environment. Due of the suspicion that the breakdown products of DEHP are endocrine disruptors, there has been a surge in research on this compound. The major purpose of *in vitro* investigation was to assess the potential cytotoxic effects of DEHP on cell membrane integrity and cell survival in TM3 cells. Eight experimental doses of DEHP were administered to mice's Leydig cells over the course of 48 hours: 0.05 M, 0.08 M, 0.1 M, 0.15 M, 0.25 M, 0.5 M, 0.75 M, and 1 M. The MTT assay was used to analyse cell viability, and the CFDA-AM assay was used to determine the integrity of the membrane. The results demonstrated a significant ($p>0.0001$; $p>0.05$) reduction in cell viability between 0.1 M and 1 M. When it came to cell membrane integrity, a similar trend was seen, with doses of 0.15 to 1 M revealing considerable damage ($p>0.0001$; $p>0.001$; $p>0.05$). The findings indicate that the addition of DEHP has a detrimental impact on cell parameters. Further comprehensive and methodical investigation is undoubtedly necessary to have a deeper comprehension of the ramifications linked to the cytotoxic impact of DEHP on both human and animal reproduction.

Key words*: DEHP, Leydig cells, membrane integrity, cell viability*

Acknowledgement: This work was supported by the Scientific Agency of the Slovak Republic VEGA No. 1/0083/21 and the Slovak Research and Development Agency Grant No. APVV-21-0168 and APVV-20-0218.

Contact address: Lucia Zuščíková, Department of Applied Biology, Faculty of Biotechnology and Food Sciences, Slovak university of Agriculture in Nitra, xzuscikoval@uniag.sk

DOI: https://doi.org/10.15414/2025.9788055228310

The fermentation quality of corn silage with addition of heterofermentative lactic acid bacteria

Matúš DŽIMA, Miroslav JURÁČEK

Supervisor: prof. Ing. Miroslav Juráček, PhD.

The aim of this study was to investigate the effect of the addition of a silage additive based on heterofermentative lactic acid bacteria strains (facultatively heterofermentative *Lactobacillus casei*, obligately heterofermentative *Lentilactobacillus buchneri*) on the fermentation parameters and dry matter content of corn silage. The experiment was carried out in collaboration with University farm Ltd. Kolíňany dairy farm Oponice. In the experiment, a staygreen hybrid with dent grain type was ensiled. Corn matter was harvested at milky-wax maturity with a self-propelled cutter with a theoretical chop length of 20±2 mm. The silage additive dose was 1g in 10 ml per ton of matter ($1.1x10^{11}$ CFU.g^{-1}). Silage was made in plastic silage mini units in two variants (n=3), namely Control (C) without addition of additive and variant with addition of Additive (A). Air was removed using a Foodsaver powerful vacuum packer (FSGSSL0300) and the units were hermetically sealed. After 8 weeks of storage under standard conditions at 22±2 ˚C, the silage units were opened. Afterwards, the dry matter, lactic acid (LA), acetic acid (AA), butyric acid (BA), pH, alcohols content and acidity of water extract (AWE) were determined in the averaged samples. The fermentation product (FP) content was calculated. The results were statistically processed using IBM SPSS 26.0 software. Descriptive statistics were performed using one-way ANOVA and statistical significance of differences was determined by t-test ($P<0.05$). The addition of heterofermentative lactic acid bacteria (heLAB) statistically significantly reduced the dry matter content of corn silages due to the heterofermentative type of fermentation (higher fermentation losses). In 1 kg of original matter, control corn silages (C) had a lactic acid content of 23.1±1.39 g, while the silages with the addition of the additive (heLAB) had 27.0±1.69 g. After 8 weeks of storage, the heLAB-treated silages were statistically significantly higher in lactic acid content by 20.3% and higher in acetic acid content by 89.3%. None of the silage variants contained undesirable butyric acid. The addition of heLAB resulted in statistically significantly higher pH (3.88±0.01 vs. 3.83±0.02) and higher AWE of the corn silages. The heLAB-treated silages had statistically significantly lower alcohols content up to 47.3% compared to the control silages. The addition of a biological additive based on lactic acid bacteria (obligate heterofermentative *Lentilactobacillus buchneri* and facultative heterofermentative *Lactobacillus casei*) after 8 weeks of storage statistically significantly increased the content of lactic acid, acetic acid, pH value, AWE and fermentation products, while statistically significantly decreased the dry matter and alcohols content of the corn silages.

Key words: *corn silage, heterofermentative lactobacilli, additive, quality*

Acknowledgement: This work was supported by the Scientific Grant Agency of the Ministry of Education, Science, Research and Sport of the Slovak Republic and the Slovak Academy of Sciences, project no. 1/0321/23 (Effective management of the ruminant nutrition using a modern monitoring of the internal environment).

Contact address: Matúš Džima, Miroslav Juráček, Institute of Nutrition and Genomics, Faculty of Agrobiology and Food Resources, Slovak University of Agriculture in Nitra, Trieda Andreja Hlinku 2, 949 76 Nitra, xdzima@uniag.sk, miroslav.juracek@uniag.sk

DOI: https://doi.org/10.15414/2025.9788055228310

The Role of Platinum Nanoparticles in Altering Rabbit Spermatozoa Motility and Velocity *In Vitro*

Lucia DIANOVÁ[1], Michal LENICKÝ[1], Kateryna VANIVSKA[1], Marko HALO jr.[1], Tomáš SLANINA[1], Ľubomír ONDRUŠKA[2], Peter MASSÁNYI[1]

Supervisor: prof. MVDr. Peter Massányi, DrSc.

Platinum nanoparticles (Pt NPs), similar to other noble metal nanoparticles like gold (Au) and silver (Ag), have attracted considerable interest because of their distinct physical, chemical, and biological characteristics. Pt NPs are known for their remarkable stability and outstanding catalytic properties. In biology and medicine, they hold promise for applications in cancer therapy, radiotherapy, and drug delivery. However, nanoparticles are increasingly being introduced into the environment through human activities, eventually making their way into the food chain. Since the toxicity of nanoparticles on living organisms remains largely unexplored, they are regarded as a potential hazard. This study aims to investigate the *in vitro* effects of Pt NPs on the motility and velocity of rabbit spermatozoa. Samples of rabbit ejaculate were exposed to different concentrations of Pt NPs (1, 30, 250, and 500 µg/mL; 0 and 2h; 37°C). Total motility (MOT) and velocity (VCL) were evaluated using CASA technology. In the initial time interval, motility and velocity were significantly decreased in concentrations 250 µg/mL (MOT-P<0,001; VCL- P<0,01) and 500 µg/mL (MOT-P<0,0001; VCL-P<0,001). After 2 hours of exposition to Pt NPs, MOT was decreased considerably in concentrations 30 µg/mL (P<0,01), 250 µg/mL (P<0,0001), and 500 µg/mL (P<0,0001). VCL was notably reduced in concentrations 250 and 500 µg/mL (P<0,0001). This short *in vitro* study discovered that platinum nanoparticles (Pt NPs) may adversely affect sperm motility parameters. Further research is needed to gain a more complete understanding of how Pt NPs affect rabbit spermatozoa.

Keywords: *Platinum, nanoparticles, spermatozoa, motility, velocity*

Acknowledgments: The research was financially supported by projects VEGA 1/0698/22, APVV-16-0289, APVV-21-0168, and KEGA 035SPU-4/2023.

Contact address: Lucia Dianová, Institute of Applied Biology, Faculty of Biotechnology and Food Sciences, Slovak University of Agriculture, Tr. A. Hlinku 2, 94976 Nitra, Slovak Republic, xdianova@uniag.sk
[2]Research Institute for Animal Production Nitra, Hlohovecká 2, 951 41 Lužianky, Slovak Republic

DOI: https://doi.org/10.15414/2025.9788055228310

Name of publication
Scientific Conference of PhD Students of FAFR, FBFS and FHLE SUA in Nitra
- Book of abstracts

Editors
doc. Ing. Martina Fikselová, PhD.
Ing. Veronika Štefúnová, PhD.
Ing. Andrea Matuškovičová
Mgr. Dominik Hollý
Ing. Zuzana Schubertová, PhD.

Publisher
Slovak University of Agriculture in Nitra, Slovakia
Tr. A. Hlinku 2, 949 76 Nitra
Slovak Republic

Form of publication: online
Edition: first
Year of publication: 2025
Pages: 67

Not edited at the Publishing House of SUA in Nitra.

Contributions are published in their original version, without any language corrections.

ISBN 978-80-552-2831-0

DOI: https://doi.org/10.15414/2025.9788055228310

SUA·FAFR Faculty of Agrobiology and Food Resources

SUA·FBFS Faculty of Biotechnology and Food Science

SUA·FHLE Faculty of Horticulture and Landscape Engineering