CASEE CONFERENCE 2022

Sustainable agriculture in the context of climate change and digitalization

Book of abstracts

Petra Kadlecová & Michal Lošťák (Eds.)

12th CASEE Conference

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FOREWORD

Dear participants of the 12th CASEE conference, dear readers of this Book of abstracts,

In 2022, CASEE universities indicated the intention to organize CASEE conference in the same format as it has been done before the outbreak of COVID-19 pandemic in 2020. Those who are familiar with CASEE activities know that in 2020 the conference was cancelled, and in 2021 the conference was organized in on-line format. The intention to resume the activities in the format conducted prior to pandemic was achieved. We will again meet face to face, although some of the presentations will be delivered on-line. However, originally planned venue in Chisinau at State Agrarian University of Moldova had to be changed dure to instability in the region resulting from Putin's war aggression over Ukraine. The new venue is in Prague at Czech University of Life Sciences. This university organized last year on-line conference and in 2022 the members of CASEE universities will have the opportunity to visit this university in-person. We will be glad, if this year conference will be a symbol of restarting the CASEE activities after COVID-19 pandemic because from 2020 CASEE was successful in attracting projects funded by EU (one Erasmus KA2 project COVIMO, and one Erasmus Mundus project DAFM), and also becoming an associated partner in one of European University Initiative networks named EPICUR.

The title of the 2022 CASEE conference is "Sustainable agriculture in the context of climate change and digitalization". The word “digitalization” shows the importance of this transition in agriculture, and having it in the title documents CASEE is a frontrunner in the region addressing issues related to internet of things, big data or artificial intelligence in agriculture. Since the decision to change the venue from Chisinau to Prague was done in May 2022, it was not easy to fully accommodate the expectations and wishes of all who submitted their abstracts. Unclear situation with the venue of the conference caused several cancellations in participation. That is the reason why this year some sessions (working groups) were merged and finally the conference consists of these sessions: (1) Digital agriculture and engineering & Environment in the context of climate change, (2) Climate-smart agriculture and food security, (3) Sustainable agriculture and forestry, (4) Current issues of agricultural economy, rural development and landscape planning & Global trends and challenges in animal husbandry and veterinary medicine. As it was the case last year, the conference focuses on young scientists and provides them one of the first international experiences.

This Book of abstracts highlights the main ideas of the oral presentations and posters presented during this conference. I am very thankful to Petra Kadlecová, Markéta Dittrichová a Lukáš Pospíšil from Czech University of Life Sciences Prague, just to mention the persons who were behind the organisation of this event. It was not easy, as I have already mentioned, because in November 2021 they visited Chisinau to work with our colleagues from Moldova on the organization of the conference. Their work together with the activities of other members of organisational committee and scientific committee were crucial for the success of this conference. Many thanks also to all others who were committed to organising such a conference, which already has its tradition and neither COVID-19 nor aggressive war did not interrupt it.

I hope all participants will enjoy this conference and will gain new ideas how to develop their work utilising the experience of CASEE universities.

Prof. PhDr. Michal Lošťák, Ph.D.
CASEE President

ORAL PRESENTATIONS

A1 Digital agriculture and engineering & Environment in the context of climate change

A1.1
To what extent can service-based business contribute to the adoption of digital farming technologies Case study of RiceAdvice application

***R. Amoussouhoui**, J. Banout;*
Czech University of Life Sciences, Prague, Czech Republic, Praha, Czech Republic.

Introduction: An efficient agricultural extension service would positively change farmers' technical habits and lead them to more efficient decision-making. However, the traditional extension approach based on government extension services and external support has shown its limit. This is evident particularly in Sub-Saharan Africa, where public agricultural extension often fails to serve farmers adequately due to financial unsustainability and high dependency on the government or donor funding, which is unreliable and leads to the discontinuation of many promising solutions. The digital extension service has the potential to overcome these limits and to help improve farmers' performance. However, farmers' adoption of digital farming technologies is still an issue due to several barriers: the lack of adequate IT infrastructure, the access and use of IT tools such as smartphones, and the education level. This study proposes a service-based (SB) business to increase smallholder adoption of digital farming technologies. We use a digital extension application design to provide personalized advice to rice farmers. This study aims to (*i*) analyze the factors that drive smallholder farmers to adopt a SB business and (*ii*) identify the SB business expected to lead to greater adoption. Methodology: The data used for this study were collected in Jigawa State in Nigeria. We used a multi-stage stratified sample method to identify the study area and the respondents. The choice experiment was used to evaluate rice farmers' choices of ten theoretical business profiles. The business profiles are defined by their characteristics, including the payment method, the price of the service, the length of the partnership, offer of credit, agreement on additional paid service, agreement for contract farming, and agreement on the quantity and quality of the product. The data were analyzed using the alternative specific mixed logit. Findings: The study also identifies the most preferred business profile, essential attributes, and socio-economic factors for an optimum business profile. Results showed that gender, age, education level, experience in rice production, knowledge of the technology, contact with extension agent, size of rice farm, and household income are the determinants of the preferred business profile. Among the ten business profiles, business profile 3 is the first most preferred with 49.4% implying cash payment after harvest at $9.70/hectare for more than two seasons contract, followed by business profile 6 with 44.7% with cash payment after harvest at $14.50/hectare for one season contract and the business profile 1 with 26.8% implying cash payment at $14.50/hectare for a one-season contract. The optimum business profile would include all education levels, $14.50/hectare as the optimum price for a cash payment after harvest with no access to credit.Conclusion: The case of this study is a digital extension technology design for a rice farmer. The study also provides a solution to decreasing public support to agriculture, especially regarding the extension in developing countries. The idea of a service-based business profile using digital farming technologies needs to be supported, promoted, and disseminated by government and technical partners to help smallholder farmers take advantage of the technological change.

A1.2
Influence of climate change on the surface water status

***L. Cesoniene**, D. Sileikiene;*
Vytautas Magnus University, Kaunas, Lithuania.

The problem examined in the work is the impact of climate change on the status of surface water. The aim of the study is to evaluate the impact of climate change on the surface water status of Kaunas district. During the research, the dynamics of average annual temperature and precipitation in 1949-2021 in Kaunas district (data of Kaunas Meteorological Station) were evaluated. After evaluating the dynamics of the average annual temperature, the tendency of the average annual temperature increase (R 2 = 0.30) was determined. Temperatures increased the most in March (R 2 = 0.20), July (R 2 = 0.11) and August (R 2 = 0.16). No linear upward trend in average annual precipitation was observed (R 2 = 0.01). Precipitation increased the most in January (R 2 = 0.20) and October (R 2 = 0.20), and decreased in April (R 2 = 0.12) and August (R 2 = 0.11). Surveys of the condition of surface water bodies in the territory of Kaunas district municipality were performed in 30 water bodies in 2008-2020. According to BOD7, the values of total phosphorus and total nitrogen in water bodies in Kaunas district usually correspond to the average values of the ecological status class. Correlation coefficients were calculated to assess the relationship between climatic conditions and water quality indicators. The results show that the higher the average annual temperature, the lower the pH values (more acidic water), the higher the values of NH4, N and suspended solids in the water. The higher the amount of precipitation, the higher the NH4 value in the water, the lower the amount of dissolved oxygen. The results show that climate change is having a negative impact on the status of surface water

A1.3
The Role of Adaptation Climate Measures in Preventing of the Climate Risk at Farm Level

***S. De Leo**, A. Di Fonzo, S. Giuca, M. Gaito, G. Bonati;*
CREA, Roma, Italy.

The overall aim of this paper is to investigate on the effectiveness of Climate Adaptation Measures (CAM) (EU COM 2021/82; Reg. CE 2021/1119) in countering climate risk damage. Our paper provides a-depth costs and benefits assessment associated with the adoption of the CAM in Italian farms. Concerns about global warming are currently attracting interest of global policy makers and the issue is central to the political and scientific debate. According to a Eurobarometer survey of 2021, after diseases, the economy and world hunger, the climate is considered the fourth emergency in Italy. The methodology illustrated will be implemented in LIFE project "*ADapation in Agriculture*"- ADA (execution stage) which aims to help improve adaptation to climate change and promote sustainable and inclusive growth in the agricultural sector. In this context, we provide a methodology framework for costs and benefits assessment of adaptation measures to climate change and their economic and environmental effects at the farm-level in Italy to improve farmers ability to face current and future climate risks. We provide an exemplary estimation model is based on entity of damage avoided - deriving by adverse climatic events - with the CAM adoption. Adverse weather events are growing frequently. Considering the average of the yields losses in agriculture in last year with strong effect on income (European Environmental Agency, 2021), for simplified our model assume that adverse climatic events can cause damage on average equal to or greater than 30% of the value of the farm's production with a high likelihood. The damage is calculated using FADN data and the average farm value Gross Production farm is considered for type of farming and its economic

size. The benefit of measure is calculated on estimate effectiveness of the measure to prevent/reduce such damage. Furthermore, other economic benefits are considered. The results provide a methodology to represent costs and benefits associated with the reduction of the climatic risk that countering the adaptation measure. The use methodology approach could be to support farmers in choosing to adoption of appropriate CAM. This framework is a prerequisite for identifying the specific support interventions for adaptation measures, mainly deriving from rural development measures to which farmers will be able to access. Climate changes directly affect productivity by affecting the profitability of farmers, especially small and medium-sized farmers, and their ability to survive, also negatively affecting the quality of production. This paper contributes to the research issue providing a methodological framework and in-depth assessment of adaption measures capability to reduction economics and environmental damage due to climate risk. It should provide a valuable tool to support environmental economists and policies.

A1.4
Integrated model for obtaining an innovative product for people with metabolic disorders - AmberCaps

***L. Mitrea**, S. A. Nemeș, D. Plamadă, M. S. Păscuță, A. Varvara, E. Simon, F. V. Dulf, D. C. Vodnar;*
USAMV - University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca , Romania, Cluj-Napoca, Romania.

The research topic is to formulate a succinic acid powder in different protective matrices, using the spray-drying technique. The powder thus formulated may be integrated into various foods and/or pharmaceuticals given the physicochemical characteristics of succinic acid, in particular the preservation and flavoring of the products in which it is integrated, and moreover due to the beneficial potential of the succinic acid on human health, especially on carbohydrate metabolism. Succinic acid is an organic compound with wide applicability in various industries (e.g. intermediate in the synthesis of biodegradable materials, food additive excipient in pharmaceuticals, etc.). AmberCaps is proposing to obtain a new multifunctional ingredient formulated in the form of an extra-fine powder containing succinic acid, which can be easily used in the development of new foods and/or pharmaceuticals, with a beneficial impact on human health due to the controlled release at the intestinal level of the microencapsulated compound. The originality and innovation of this project are that succinic acid is formulated in the form of a functional powder making it available as such and not in the form of succinic derivatives, a product that can be easily integrated into various food matrices or pharmaceuticals dedicated to people with carbohydrate metabolism disorders, especially people suffering from type II diabetes or obesity. Acknowledgment: This research was funded by the Ministry of Research and Innovation, CNCS-UEFISCDI, project PNIII-P1-1.1-PD-2019-0679 (*SuccinYst*).

A1.5
Development of sustainable active packaging by using nanocarriers: a step to environment safe

***M. S. Pascuta (Canalis)**, L. Mitrea, S. A. Nemes, K. Szabo, B. E. Teleky, D. C. Vodnar;*
USAMV - University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca , Romania, Cluj-Napoca, Romania.

Introduction: Active packaging obtained from biopolymers such as polysaccharides, proteins, lipids, and their composites has gained interest to combat plastic waste. Biopolymers are renewable, non-toxic, and environmentally safe. However, food packaging requires certain physical, chemical, and mechanical performances. Above-mentioned biopolymers do not satisfy such requirements. Active compounds such as essential oils were used to improve the mechanical, antioxidant, and antimicrobial properties of active biofilms. However, active compounds have low stability and can easily burst when added directly into biopolymeric materials. Due to these drawbacks, encapsulation into lipid-based, polymeric-based, and nanoclay-based nanocarriers has currently captured increased interest. Nanocarriers can enhance the performance of biopolymeric matrices and can protect and control the release of active compounds. **Aims:** This work aims to give an overview of the main classes of nanocarriers used to develop sustainable biopolymeric-based active packaging. A short characterization of delivery systems and the benefits of their incorporation into biopolymeric matrices are mentioned. **Results:** Active compounds-loaded nanocarriers increase the shelf life and durability of biopolymeric-based active packaging. They improve the physical, chemical, and mechanical properties of the biopolymeric matrix. In addition, nanocarriers increase the bioactivity of active compounds by offering protection, stability, controlled and targeted release. Biofilms with improved antimicrobial and antioxidant activities increase food shelf life. The lower the nanocarrier size, the higher the release rate of active compounds. The techniques used to produce nanocarriers influence their efficiency in improving biofilms characteristics. **Conclusion:** Incorporating nanocarriers into biopolymeric matrices are suitable for developing active biofilms with tailored characteristics. Biopolymeric-based active packaging is considered an excellent strategy to combat plastic waste for a healthy environment. With antimicrobial and antioxidant activities, edible biofilms can reduce food loss and food waste.
References: [1] M. S. Pascuta and D. C. Vodnar, 'Nanocarriers for Sustainable Active Packaging: An Overview during and Post COVID-19', *Coatings*, vol. 12, no. 1, p. 102, Jan. 2022, doi: 10.3390/coatings12010102. [2] L. Kuai, F. Liu, B. Sen Chiou, R. J. Avena-Bustillos, T. H. McHugh, and F. Zhong, 'Controlled release of antioxidants from active food packaging: A review', *Food Hydrocoll.*, vol. 120, no. February, p. 106992, 2021, doi: 10.1016/j.foodhyd.2021.106992. [3] A. Trajkovska Petkoska, D. Daniloski, N. M. D'Cunha, N. Naumovski, and A. T. Broach, 'Edible packaging: Sustainable solutions and novel trends in food packaging', *Food Res. Int.*, vol. 140, no. December 2020, p. 109981, 2021, doi: 10.1016/j.foodres.2020.109981.

A2 Climate-smart agriculture and food security

A2.1
Demonstrating yield advantage and profitability of selected climate smart technologies in northern Uganda

***M. Okao**[1,2], G. A. Otim[2], G. Mutoni[2], L. Ogwal[2], A. Komaketch[2], L. F. Turyagyenda[2], R. Bharati[1], E. F. Cusimamani[1];*
[1]Czech University of Life Sciences, Prague, Czech Republic, Prague, Czech Republic, [2]Ngetta Zonal Agricultural Research and Development Institute, Lira, Uganda.

The limited use of inputs such as fertilizer and improved seed, moisture stress due to climatic variability and poor farming practices are major causes of low maize yield in Uganda. Consequently, the productivity continues to remain below the potential threshold. Climate-smart agriculture (CSA) is viewed as a potentially effective intervention to address low agricultural productivity in Sub-Saharan Africa (SSA) while strengthening farmers' capacity to adapt to the effects of climate change. Therefore, three on-farm trials and one on-station trial (RCBD design) were conducted in Northern Uganda during two cropping seasons. The aim of the study was to assess maize yield response to three CSA practices; ripping, permanent planting basins and alley cropping; and evaluate the profitability of their use in comparison with non-fertilizer amendments. It was deduced from the study that ripping, planting basins and alley cropping with *Gliricidia sepium* gave the greatest yield advantage of 457.1, 456.7 and 437.2 kg/acre respectively. Fertilizer application significantly increased yield advantage but this increment did not necessarily translate to cost-effectiveness due to associated costs. In fact, minimum tillage interventions were more profitable without fertilizer application; and at some locations responded poorly to fertilizer application. These variable responses indicate the need for developing site-specific CSA interventions for improved maize productivity and profitability. Following investigation, the use of permanent planting basins, rip lines and alley cropping with *Gliricidia* were found to be profitable CSA practices for maize production in northern Uganda.

A2.2
Comparative environmental life cycle assessment of a stilted and vertical bifacial agri-photovoltaic system

***T. Krexner**, A. Bauer, C. Mikovits, J. Schmidt, M. Schönhart, T. Schauppenlehner, E. Schmid, A. Gronauer, F. Medel-Jiménez, I. Kral;*
BOKU - University of Natural Resources and Life Sciences, Vienna , Austria, Vienna, Austria.

Agri-Photovoltaic (APV), which is the combined use of agricultural land for production of food/feed and solar electricity with photovoltaic (PV) modules, has been a popular topic of research in recent years. So far, no holistic assessment of environmental impacts has been done. Hence, this study aims to compare a stilted (S-) APV with a vertical bifacial (VB-) APV system with the method of life cycle assessment (LCA). Further, the management scenarios of an unmodified agricultural production (Agri-only) and a total substitution of agricultural production by PV-modules (PV-only) are assessed. PV-only scenario assumes 1 $MWp*ha^{-1}$ with mono-Si PV-modules. S-APV has an interrow space of 12 m with an additional flower strip of 0.5 m, which makes 96 % of the area useable for agricultural production. Mono-Si PV-modules are used with a total of 430 $kWp*ha^{-1}$. VB-APV has an interrow space of 10 m with an additional flower strip of 0.4 m on each side, thus 91 % can be used for agricultural production. Vertical bifacial PV-modules are used with a total of 349 $kWp*ha^{-1}$. As functional unit (FU), which is the reference to which all inputs and outputs are referring to, a sum of electricity and agricultural goods produced over 4 years is used. To produce the same outputs in every scenario, in the Agri-only scenario an additional production chain for electricity is needed; while one for agricultural production is needed in the PV-only and S-APV scenario. For all scenarios an average crop rotation in Lower-Austria (Bruck/Leitha) consisting of sugar beet, winter wheat, soybean and winter wheat is assumed. The use of agricultural machinery with different working widths is adjusted to every scenario. To model the additional production chain of agricultural goods for the PV-only scenario, the self-sufficiency factor of Austria for the mentioned crops is considered, while an average Austrian production is used for the S-APV scenario. Fertilizer use and field emissions are calculated for both APV-scenarios with a wide range of emission models such as IPCC, SALCA-Nitrate, SALCA-heavy metals, SALCA-Phosphorus and EEA2019. Electricity production values are simulated for every scenario based on CCCA ÖKS 15 global radiation data (rsds) and 10m x 10m DHM (digital height map) values.Preliminary results show a global warming potential (GWP) of 184 t CO_2 eq. per FU for VB-APV and 290 t CO_2 eq. per FU for S-APV, respectively. The GWP of the PV-only scenario is slightly higher; for the Agri-only scenario much higher. For the latter, this is due to the high impact of the electricity production based on the Austrian production mix. A hotspot for the APV-scenarios is the PV-module production in China (53-58 %), due to the high demand and impact of electricity used for the solar grade silicon production. In the S-APV scenario the mounting structure, especially due to the high demand of steel, is another hotspot (30 %), while for VB-APV the impact is lower with 12 %. Overall, the agricultural production has lower impact. Hotspots in the latter part are the field emissions carbon dioxide and dinitrogen monoxide.More impact categories will be assessed based on the methodological framework from ISO 14040 [1].
References:[1]ISO 14040 (2006). Environmental management - Life cycle assessment - Principles and framework; International Standard (ISO 14040:2006) (Second edition (2006-07-01). ISO Copyright Office.

A2.3
Influence of metal oxide nanoparticles on soybean plants

***C. Coman**, D. Clapa, I. Oprea, F. Ranga, A. Cadiș, F. Scurtu, D. Vodnar, V. Coman, L. Leopold;*
USAMV - University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca , Romania, Cluj-Napoca, Romania.

Engineered nanomaterials (ENM) are nowadays used in many branches of industry and their use has brought significant advances, ranging from energy production and storage, agricultural and environmental applications, to targeted drug delivery systems. Unfortunately, extended manufacturing and use of ENM may become an environmental issue, due release of significant amounts of such materials into the environment (air, water, landfills and soil).[1,2] We have assessed the accumulation of zinc oxide and titanium dioxide nanoparticles (ZnO-NPs and TiO_2-NPs) in soybean (*Glycine max*) plants grown *in vitro*, their impact on different plant metabolites (chlorophylls, carotenoids, ascorbic and dehydroascorbic acids), on plant growth, and plant morphology. The exposure concentrations were 0, 10, 100, and 1000 mg/L.A clear negative effect on plant morphology, with suppression of plant growth was observed for exposures to ZnO-NPs of 100 and 1000 mg/L. The root morphology was adversely affected, with almost complete inhibition observed at doses of 1000 mg/L. On the contrary, TiO_2-NPs showed no negative impact on the morphology of soybean plants at all applied concentrations. ICP-OES experiments showed that the NPs are accumulated in the soybean plant in a dose-dependent manner. A preferential accumulation in the roots *vs* stems and leaves occurred. ZnO was uptaken in much higher amounts compared to TiO_2 (2 to 10 times, depending on the plant organ).ZnO-NPs and TiO_2-NPs showed opposite effects on secondary plant metabolites. On one hand, dose-dependent decreases in chlorophyll A and B levels compared to controls were observed upon ZnO-NPs exposure, as well as decreased levels of beta-carotene, zeaxanthin, and lutein. On the other hand, TiO_2 exposure resulted in increased levels of both chlorophylls and carotenoids. The levels of ascorbic and dehydroascorbic showed a slight increase following exposure to increased levels of TiO_2, while ZnO significantly increased the levels of the same analytes (e.g. 1.5 fold in the case of ascorbic acid). Such pronounced effects of ZnO-NPs on the levels of antioxidant molecules can be related to a stress response of the plant.The results of our study showed significant differences between the accumulation and toxicity pathways of ZnO-NPs and TiO_2-NPs in the soybean plant.Acknowledgements: This work was supported by two grants of the Ministry of Research and Innovation, CNCS - UEFISCDI, project number PN-III-P1-1.1-TE-2019-1424 and project PN-III-P1-1.2-PCCDI-2017-0056, within PNCDI III.
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A2.4
Aspects regarding the integration of cereals by-products in the food chain

***A. Farcas**, S. Socaci, M. Tofana, T. Coldea, S. Chis;*
USAMV - University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca , Romania, Cluj-Napoca, Romania.

Nowadays, the multinational and craft beer and distilled beverage producers represent one of the biggest agro-industrial waste generators, with a high impact on the environment, economy and therefore on society. The recovery of bioactive compounds from residues and agri-food by-products is considered a research topic of great interest, all the laboratory/pilot case studies being extremely important, as they have a major contribution in creating a scientific database to support the sustainability of reintegration processes at industrial scale. Furthermore, the pandemic situation has encouraged the concept of circular bio-economy and the idea of sustainable foods, leading to change the consumption trends towards a healthier and more balanced diets. In these contexts, the aim of the present research is to evaluate the chemical variability of five different grains by-products and their impact on the nutritional composition, functional properties and sensorial profile of some new developed food products. The cereal by-products were collected from local breweries, tested regarding proximate composition, bioactive compounds and volatile aroma profile, and then integrated in the composition of different food products. The results highlighted significant differences between the spent grain samples, mainly due to the raw materials used in the brewing process, but in general, the partial substitution of flour with these unconventional ingredients enhanced the nutritional values of the final baked goods and improved their sensorial attributes. Furthermore, the products manufactured with by-products resulted from malt mixture were the most appreciated, mainly because of its visual aspects and more complex aromatic profile. Acknowledgement: This work was supported by a grant of Ministry of Research and Innovation, CNCS - UEFISCDI, project number PN-III-P2-2.1-PED-2019-3622, within PNCDI III.

A2.5
Carotenoids recovery from tomato processing industry and their reintegration in the food chain through microencapsulation process

***K. Szabo**, B. Teleky, L. Calinoiu, L. Mitrea, D. Vodnar;*
USAMV - University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca , Romania, Cluj-Napoca, Romania.

Tomato processing by-products are an inexpensive source of carotenoids in the context of bio—based economy, which involves principles related to the food waste reduction and to the integration of recovered nutrients into the market. In the field of food industry, approximately 42 million tons of tomatoes are processed yearly generating tomato peels, tomato seeds and the mixture of these two together, called tomato pomace as by-products, which sum up 5-30% of the main product. Carotenoids have well documented health-promoting functions due to their antioxidant properties, and numerous research topics are associated to their integration in functional food products or beverages. Because of their firm hydrophobic nature, some difficulties are encountered while incorporating carotenoids in high water content matrices. The present research aimed to follow the circular economy strategy, through a longitudinal study involving the recovery of the major bioactive components from tomato processing industrial by-products, efficiently valorize them by developing microencapsulated carotenoids *via* spray drying technology, and to test the bioaccessibility of the carotenoids by *in vitro* digestion model using the recently updated harmonized INFOGEST method. Oil in water emulsion delivery system was used for encapsulating carotenoids with linseed oil as carrier, and a binary blend of gum Arabic and maltodextrin (1:1 w/ w) as wall materials. The microcapsules were subjected to physical-chemical analysis, and to simulated gastrointestinal digestion process to evaluate the carotenoids bioaccessibility. Individual carotenoids (lycopene, β-carotene, and lutein) were observed during gastric and intestinal phases of the *in vitro* digestion and analyzed by high performance liquid chromatography coupled to mass spectrometry. The results showed considerable degradation of lycopene during spray drying process and consistent degradation of β-carotene throughout the gastric phase of the simulated digestion. To gain an insight into the compounds responsible for the efficient delivery system of the carotenoids through the gastrointestinal tract, further investigations are required regarding the lipid phase used in the spray drying process.

A3 Sustainable agriculture and forestry

A3.1
Devising a rural food system framed by the United Nations Sustainable Development Goals

***H. E. D. Barlow**;*
Czech University of Life Sciences, Prague, Czech Republic, Praha, Czech Republic.

This research looks at the complexities and injustices within the English food system and uses the framework of the United Nations Sustainable Development Goals (SDGs) to understand how these complexities could be addressed and how policy could be used to deliver the UK's commitment to the SDGs. The methodology for this research is based on a mixed-methods approach, firstly using interviews to talk with farmers, food producers and growers (FPGs) to establish an understanding of the issues faced by those who operate with the sector on a daily basis and surveys to understand how the SDGs fit in modern food production and how those within the sector perceive the relevance of the 17 goals to farming and food production. Focusing on three key food production regions in England, Eastern England, East Midlands and the South West, the data provided from these areas will allow for regional comparison and also analysis of the data set as a whole. In the latter stages of the research policy discourse analysis will look at Government policy, due to be updated post Brexit to establish the narrative of future policy and if it bears relevance to fulfilling the SDGs. The results from 70 interviews conducted over the three regions revealed many reoccurring themes for example the destruct impact of the Common Agricultural Policy, the effects of the pressures within the retailer supply chains and the ever-increasing labour crisis within agriculture and horticulture as well as the impacts of climate change on farming. There is also a definite acknowledgement of the need for a greater environmental policy with specific sector-specific targets and also the addressing heavy impact of the CAP on the farming sector as a whole. The success of small local supply chains offers hope that economic stability can be found within the sector without the need for subsidisation from Government. There are multiple issues discussed within this research and once completed the comparisons of the regions will provide an interesting insight into the agricultural and horticultural sectors of England.

A3.2
Floating hydroponics as a sustainable agricultural practice in nettle cultivation - successful management of nutrient solution

*N. Opačić, **M. Dujmovic**, J. Šic Žlabur, S. Fabek Uher, B. Benko, N. Toth, L. Čoga, M. Petek, S. Voća, S. Radman;*
University of Zagreb, Croatia, Zagreb, Croatia.

The need for sustainable production of nutrient-rich foods is critical both for environmental protection, mainly to reduce footprint on the soil, water and air, and for human health. Therefore, agricultural practices are increasingly shifting to greenhouse cultivation, where abiotic factors can be controlled and optimized regarding to the specific needs of each plant species. Hydroponic cultivation stands out as a successful growing system that provides a controlled environment, water and nutrient consumption ensuring higher yields, better morphological characteristics and favorable mineral composition. Floating hydroponics is offered as one of the techniques whose main advantages are the elimination of potential problems caused by soil contamination, the possibility of lower water consumption and precise and balanced plant nutrition. Stinging nettle (*Urtica dioica* L.) is a perennial plant species characterized by the possibility of retrovegetation and multiple harvesting, which makes it interesting for agricultural production. However, it also tends to accumulate heavy metals and excessive amounts of nitrogen from the soil. Therefore, it poses a challenge in terms of questionable plant material for further use and consumption. As nettle becomes more popular among consumers, mainly due to its favorable nutrient composition, high antioxidant and essential minerals content, its cultivation is necessary to ensure consistent chemical composition and high quality. The aim of this study was to determine the effects of nutrient solution (NS) content during two harvesting periods on the morphological characteristics, dry matter and macroelements content of fresh nettle leaves. The experiment was conducted in a heated greenhouse during the fall-winter growing season of 2021/2022. Nettle was grown in basins filled with NS standardized according to Johnson's (EC 1.5 mS/cm). Management of the solution during cultivation was varied as follows: basin 1 (B1) and 2 (B2) were filled with Johnson's solution prepared independently of the water chemical composition while in basin 3 (B3) Johnson's NS was adjusted according to the water chemical analysis. After the first harvest, only water was added in B1 to replace the drop level of NS; in B2 the initial NS was added; in B3 the amount of nutrients was added to match the composition of the initial standard solution based on the NS analysis performed after the first harvest. Two harvests were carried out (Nov 3, 2021 and Jan 11, 2022), after each, morphological and chemical analyses were conducted and the results were statistically analyzed. The results show that both factors, NS variation and harvest period, have a significant influence on the morphological characteristics, yield and macroelement content of fresh nettle. In the first harvest, values for nettle plant height (28.53 cm), leaf length (7.57 cm), width (6.07 cm) and yield (1.26 kg/m2), as well as for N and P (5.83% N dry weight (dw) and 1.15% P dw) were generally higher regardless of the solution variant. The second harvest resulted in higher dry matter (22.12%) and K (4.16% K dw) values. The lower values of all morphological parameters and macroelements found in nettle in the basin supplemented with water prove that in case of multiple harvests, correction of NS is necessary to obtain adequate yield and nutritional value of the final product.

A3.3
Phenolic compounds from apple pomace - a sustainable source and a start for novel prebiotics

D. Plamada[1,2]*, H. Kieserling*[2]*, S. Rohn*[2]*, D. C. Vodnar*[1]*;*
[1]USAMV - University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca , Romania, Cluj-Napoca, Romania, [2]Technische Universität Berlin, Institute for Food Technology and Food Chemistry, Department of Food Chemistry and Analysis, Berlin, Germany.

Apple juice is one of the most widely consumed fruit juices globally. However, the apple pomace (AP) obtained after apple juice production is currently a by-product, thus mostly discarded. Therefore, numerous branches of research focus on the sustainable recycling of the nutrients contained in apple pomaces, such as the extraction of proteins, dietary fibers, and phenolic compounds. Since in particular the phenolic compounds are known for their antioxidant effects, their incorporation in food promises increasing health and physiological benefits. A necessary prerequisite for the incorporation of extracted phenolic compounds in food is the complete characterization of their properties (identification and quantification of the phenols, antioxidativity, stability, and prebiotic effects) during the handling and processing of food or food supplements. However, it is currently unclear whether the properties of the phenolic compounds after extraction are stable and whether they are retained when the food is processed. The aim of this research is hence the extraction and chemical characterization of the phenolic compounds from apple pomace as well as the investigation of their stability during food processing. Three-stage solvent extraction was chosen as the extraction process. First, free phenolic compounds were extracted with aqueous methanol then, the residue was subjected to base and acidic hydrolysis including an extraction with diethyl ether/ethyl acetate. The content of free phenolic compounds in aqueous-methanol extracts amounted 8.1 - 13 mg gallic acid equivalents (GAE)/g dry weight AP, with the major free phenolic compounds identified as phloridzin, chlorogenic acid, quercetin, a proanthocyanidin dimer, and catechin. The sequential base and acidic hydrolysis yielded 3.4 - 6.8 mg GAE/ g AP. The antioxidant activity was measured by Trolox equivalent antioxidant capacity assay correlated with the total phenolic content, as the free phenolic fraction showed the highest antioxidant capacity compared to the hydrolyzed samples. In this work, it was shown that the sequential extraction of apple pomace is a suitable method to obtain a high quantity of phenolic compounds with a certain antioxidant capacity. However, further tests are needed to analyze the basic chemical characterization and the degradation stability of the extracted phenolic compounds during commonly applied food processing. Acknowledgments: D. P. was financed through a fellowship supported by the German Federal Environmental Foundation (DBU).

A3.4
Specalized metabolites accumulation in mung bean microgreens under the influence of LEDs supplemental illumination

R. Vrkić*, J. Šic Žlabur, B. Benko;*
University of Zagreb, Croatia, Zagreb, Croatia.

Microgreens are becoming increasingly popular with consumers, not only for their exceptionally intense flavor and color, but also as a functional food with high nutritional value and strong antioxidant activity. Growing microgreens in greenhouses, especially in winter, presents a number of challenges, most notably a lack of light. Light is one of the key factors for optimal plant growth and development, for obtaining adequate yields, but also for the accumulation of various phytochemicals. Quality (wavelength) and photoperiod (duration) are the main light factors that directly affect the morphological characteristics of plants and a number of changes in metabolic functions related to nutrient composition and synthesis of specific metabolites (SM). Photosynthetically active radiation (PAR) includes wavelengths in the range of 400 - 800 nm, with specific photoreceptors of plant cells absorbing red, dark red, blue, and ultraviolet (UV-A) wavelengths. Optimization of the key factors of light, quality and quantity, can significantly positively affect the synthesis of various SM of plant, such as vitamins, polyphenolic compounds, pigments and other compounds of high antioxidant activity. The aim of this study was to determine the influence of red (620 nm) and blue (450 nm) spectra and different photoperiod (12 and 16 h) of supplemental light-emitting diode (LED) illumination on the composition of some SM and antioxidant capacity of mung bean microgreens (*Vigna mungo* (L.) Hepper)). The study was conducted in a climate chamber with controlled ecological conditions (25 °C, 60% humidity) under supplemental illumination by LEDs. Microgreens mung beans were manually cut at the base of the hypocotyl in cotyledon phenophase at a height of 12 cm and the following SMs were analyzed in the fresh plant material: ascorbic acid content (AsA), total phenolic content (TPC), and antioxidant capacity (by ABTS). The highest levels of AsA (61.74 mg/100 fw) and TPC (223.96 mg GAE/100 g fw) in mung bean microgreens were determined by treatment with LEDs in the red spectrum at a photoperiod of 16 hours. During the photoperiod of 12 hours, higher levels of AsA (50.56 mg/100 g body weight) and TPC (191 mgGAE/100 g body weight) were determined by blue spectrum illumination. Quality and photoperiod had no significant effect on antioxidant capacity. Regardless of the different treatments, antioxidant capacity values were generally high, with an average value of 2374.09 µmol TE /L, indicating that mung bean microgreens represent plant material with high nutritional and functional value. The obtained results indicate that proper management and optimization of quality, i.e. light intensity (selection of appropriate spectrum and photoperiod), can significantly affect the nutritional quality of the plant material and improved synthesis of SMs. From all this, it is clear that further research on specific light factors is needed to optimize the cultivation of plant material with adequate yield and high functional properties.

A3.5
Fungicide residues in some berry fruits
Sanja Lazić*, Dragana Šunjka*, Slavica Vuković, Antonije Žunić, Aleksandra Šušnjar, Dragana Bošković;*
University of Novi Sad, Novi Sad, Serbia.

Climate changes, as the most challenging environmental issue, strongly influence the occurrence and prevalence of plant diseases, as well as pesticide application. Considering that the growing of berry fruits requires intensive protection against pests and diseases, it can lead to the accumulation of pesticides in agricultural products. Favorable conditions for the most important diseases of berry fruits, such as grey mold (Botrytis cinerea Pers.), anthracnose (Colletotrichum fragariae), leaf scorch (Diplocarpon earliana), common leaf spot (Mycosphaerella fragariae) and Raspberry spur blight (Didymella applanata), and fact that they may occur several times during the growing season, require intensive fungicide application. For their control in the main berry fruits, strawberry and raspberry, the application of PPPs based on boscalid and pyraclostrobin have shown high efficacy. However, the application is sometimes conducted even during harvest, with the potential of the occurrence of fungicide residues. This study was carried out in order to evaluate the possibility of the shortening of the pre-harvest interval (PHI) of the named fungicides in strawberries and raspberries. In the field trials, set up in Serbian agroecological conditions, strawberries and raspberries were treated with the commercial formulation (267 g a.i./kg boscalid and 67 g a.i./kg pyraclostrobin) in the application rate of 1.5 kg/ha, according to the manufacturer's recommendation, when fruits were in the BBCH 87 scale. Using a validated QuEChERS-based method, followed by HPLC, fungicide residues were analyzed. The content of boscalid residues in strawberry and raspberry fruits immediately after drying the deposit was similar, 10.23 mg/kg and 10.6 mg/kg. Pyraclostrobin residues in strawberries and raspberries 1h after the application were 4.23 mg/kg and 7.63 mg/kg. Maximum residue level (MRL) of boscalid and pyraclostrobin (6 mg/kg and 1.5 mg/kg) in strawberry fruits were reached between 3rd-4th and the 4th-5th day after treatment, while the MRL of the same fungicides (10 mg/kg for boscalid and 3 mg/kg for pyraclostrobin) in raspberries were obtained one and four days after the application. Based on the results obtained in this study, a PHI of seven days is correctly prescribed for this combination of active ingredients applied in strawberries and raspberries, and it cannot be reduced. Reducing the PHI would increase the risk of the occurrence of fungicide residues above the MRL, especially residues of pyraclostrobin. This study is a part of the project No. 451-03-68/2022-14/200117, funded by the Ministry of Education, Science and Technological Development of the Republic of Serbia.

B1 Current issues of agricultural economy, rural development and landscape planning

B1.1
The national ecological network and green infrastructure in Czechia

***P. Kadlecová**;*
Czech University of Life Sciences, Prague, Czech Republic, Praha - Suchdol, Czech Republic.

Current major threats for European biodiversity are intensification of agriculture and forestry, urbanisation, and infrastructure development. Based on the EU Biodiversity Strategy, the nature conservation approach was replenished by the Green Infrastructure concept to establish a common ecological network in Europe. Nevertheless, its implementation on local levels is ambiguous. The aim of this study is to show different approaches to ecological networks in European countries and how they implement the EU Green Infrastructure Strategy. The main focus is on the Czech national ecological network called ÚSES or TSES (Territorial System of Ecological Stability), a powerful landscape planning tool established by Act No. 114/1992 Coll. on Nature and Landscape Protection. The Green Infrastructure got substantial attention from the Czech scientific community and landscape architects. Still, it was not understood as an extension of the current network but rather as its up-to-date version. As the EU strategies are not binding legal acts and the TSES network was already well-established in Czechia, they rather coexist than complement. For effective biodiversity protection, both concepts should be interconnected and further developed.

B1.2
Understanding the new discourses in the world of food policy: a dive into social media

***B. Minotti**, H. Barlow;*
Czech University of Life Sciences, Prague, Czech Republic, Prague, Czech Republic.

There is an awareness building that food policies must integrate sectoral policies, for a more sustainable food production system, this realisation is gaining prominence at an international and national level, examples are SDGs, Farm to Fork Strategy, Green New Deal. Hence, the need to create more integrated policies starts with the idea that food policy is more than health, agricultural or nutrition policy as individual strands. This integration need is part of policy narratives. Previous studies have analysed this topic, categorising the food policies discourse into paradigms. Although these paradigms are still valid, new narratives have entered the political space of food policies since 2015, when this thesis was first published. The drive for these new narratives have evolved from such societal issues as the unsustainability of food production, climate change, coexistence of overnutrition and undernutrition, COVID19's impact on the food system, has all played a part in the public discourse in recent years. Moreover, in recent years, social media has started to have an influential part in how agendas are set. Examples are flourishing all over the world, showing how important social media is in setting the political agenda and giving voice to new actors. Social media analysis in the modern world is fundamental in monitoring and identifying current technological trends, which can be extremely useful to governments and policy making. With such diverse populations accessing social media and the multiple ways in which users can express views, define experiences and promote research results, social media is a valuable resource for analysis. Hence, the study first performed a narratives policy analysis on 14 interviews among UK and Italy with the aim to understand and compare these two contexts and draw conclusions regarding the new narratives and paradigms emerged in the past years and the role of social media in the diffusion of those narratives.

B1.3
BIUXX

***I. Salman**;*
Czech University of Life Sciences, Prague, Czech Republic, Prague, Czech Republic.

Syria is a country where smallholder farms are prevalent and farm succession is problematic due to massive migration and loss of young men in a war conflict. However, due to small landholdings, large family sizes, and high off-farm wages (reflected in heavy dependence of farmers on off-farm income), many youths and young adults in low and middle-income countries prefer to participate in off-farm work activities. Moreover, the crisis changed age, gender, and education structures in the population as a result of different factors, including the increased number of male deaths compared to female as well as the impact of displacement, migration, and asylum-seeking This research aimed to explore factors influencing farm succession processes in Syria and the obstacles encountered during this process to bring more light to the farm succession. Understanding these influences will fill a significant gap in knowledge related to succession in smallholder agriculture and result in the development of targeted policies that will make farm transfer between generations less problematic and more efficient. We selected the Coastal region of the Mediterranean Sea for our case study. Although the Coastal region is relatively small, it contributes significantly to national agricultural production. Further, this is a relatively safe area where data collection is possible. The target population for this research will comprise of two groups of respondents (Farm head "the decision-maker about farm succession", Children (Potential farm successors between 18-24 years of age). A comprehensive mixed methodology including both qualitative methods and quantitative analysis will be used to identify factors that determine the intergenerational succession in family farm businesses by the mean of regression model. The research makes an original contribution to understanding the intergenerational farm transfer process as the importance to family farm succession has been increasingly questioned in current literature, by offering insights into succession and developing our understanding of succession as a process. This research represents an unequivocal response to the factors influencing the farm succession process and neglect of the potential successor by offering a clear working definition of these factors, stemming from a lack of understanding of exactly who the potential successor is, including the succession status of farms and the process of transfer of managerial control.

B1.4
The impact of cryopreservation on the course of capacitation and comparison of changes in cryopreserved and *in vitro* capacitated bovine spermatozoa

***F. Benko**, M. Ďuračka, N. Lukáč, E. Tvrdá;*
The Slovak University of Agriculture in Nitra , Slovak Republic, Nitra, Slovakia.

Nowadays, cryopreservation and artificial insemination (AI) have a global impact on the production of livestock. Still, low temperatures and thermal shock during cryopreservation can affect the viability, vitality, and oxidative profile of sperm cells. The objective of our research was to evaluate the impact of cryopreservation on the course of capacitation by comparing cryopreserved and *in vitro* capacitated bovine spermatozoa. Cryo-induced capacitation also known as cryocapacitation is often connected with a reduced quality of post-thaw semen, which has a direct effect on the success of AI. As a biological material we used ejaculates from sexually mature Holstein bulls (n=30) obtained from a local farm. The samples were separated

into three fractions, the first fraction was incubated in physiological saline solution as a control (CTRL) and the second fraction (CAP) was incubated in a capacitation medium at 39°C and 5% concentration of CO_2 for 30 min. The third fraction was cryopreserved (CRYO) and stored in liquid nitrogen at -196°C for later analysis. The motility of spermatozoa was evaluated by CASA (Computer Assisted Semen Analysis) while the integrity of cell membranes was observed with a triple fluorescent staining method. The capacitation patterns between the fractions were evaluated using fluorescent chlortetracycline staining. To quantify superoxide production we used NBT-test and optical density was measured spectrophotometrically. The concentration of hydrogen peroxide was detected with the fluorescent Amplex Red reagent. The obtained data showed a significant reduction ($P<0.0001$) of sperm motility and membrane integrity in the CRYO group against CAP and CTRL group. In the case of capacitation changes there was a significant decrease ($P<0.0001$) of capacitated cells in the CRYO group compared to the CAP group. However, there was a statistical increase ($P<0.01$) in the number of cells, which underwent acrosome reaction in the CRYO group against CAP or CTRL. In the case of the oxidative profile the concentration of superoxide was significantly higher in the CAP group after comparison to CRYO ($P<0.0001$) and CTRL ($P<0.001$) while the statistical highest ($P<0.0001$) amount of hydrogen peroxide was in the CRYO group against CAP and CTRL. Based on the results we may conclude that cryopreservation process has a negative impact on almost all parameters including functional activity, structural integrity and oxidative profile of cryopreserved bovine spermatozoa.
This publication was supported by the Operational program Integrated Infrastructure within the project: Creation of nuclear herds of diary cattle with requirement for high health status through the use of genomic selection, innovative biotechnological methods, and optimal management of breeding, NUKLEUS 313011V387, cofinanced by the European Regional Development fund.

B1.5
The effects of epicatechin on the expression patterns of selected genes involved in capacitation changes to bovine cryopreserved spermatozoa

***E. Tvrda**, S. Banas, F. Benko, M. Duracka, J. Ziarovska;*
The Slovak University of Agriculture in Nitra , Slovak Republic, Nitra, Slovakia.

While the role of sperm storage at low temperatures as a critical pillar of reproductive technologies is undoubtable, its full potential is not fully exploited yet, since a complete understanding of the sperm cryobiology is still lacking. Cryoshock-induced alterations to the key sperm structures may result in changes mimicking natural capacitation, however severely damaging the cells which will be less stable upon their transfer to the female reproductive tract, and with a limited potential to reach and fertilize the oocyte. An appealing strategy to overcome cryocapacitation of frozen spermatozoa is the supplementation of biologically active substances exhibiting membrane-stabilizing, motility-promoting, and antioxidant effects. Out of these, epicatechin (EPI), a green tea polyphenolic flavonol has shown promise in the prevention of alterations to the motion behavior and membranous structures of cryopreserved sperm. As such, the aim of this study was to assess the effects of selected doses of EPI on the motility, capacitation status of cryopreserved bovine spermatozoa alongside its role in the expression profiles of the cation channel sperm associated 1 (CatSper1) protein and protein kinase A (PKA). Semen samples from 12 sexually mature Holstein-Friesian bulls were cryopreserved in a commercial semen extender containing 25 µmol/L, 50 µmol/L and 100 µmol/L EPI or containing no supplement. Sperm motility was evaluated with computer assisted semen analysis while the capacitation status was assessed with the fluorescent chlortetracycline assay. Quantification of isolated RNA was performed by real-time PCR and expression of the CatSper1 and PKA gene was validated with Western blot. Our results indicate that the presence of 50 µmol/L and 100 µmol/L EPI resulted in higher sperm motility ($P<0.01$) and a concomitant decrease of prematurely capacitated spermatozoa ($P<0.01$). Expression of CatSper1 as well as PKA were significantly enhanced on both gene as well as protein level following sperm exposure to 50 µmol/L ($P<0.05$) as well as 100 µmol/L EPI ($P<0.01$). Based on our data we may conclude that epicatechin as an alternative cryosupplement may offer a higher level of protection to premature capacitation and associated motility loss because of sperm cryodamage, partially by stabilizing the expression of proteins that play major roles in the functional activity of male gametes.This publication was supported by the Operational program Integrated Infrastructure within the project: Creation of nuclear herds of dairy cattle with requirement for high health status through the use of genomic selection, innovative biotechnological methods, and optimal management of breeding, NUKLEUS 313011V387, co-financed by the European Regional Development fund. Research activities of this publication were also supported by the KEGA 008SPU-4/2021 and APVV-15-0544 grants.

B2 Climate-smart agriculture and food security

B2.1
Itaconic acid-based renewable biopolymers

***B. Teleky**, L. Mitrea, M. Pascuta, S. Nemes, L. Calinoiu, B. Stefanescu, A. Martau, E. Simon, G. Barta, K. Szabo, D. Plamada, G. Precup, A. Varvara, D. Vodnar;*
USAMV - University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca , Romania, Cluj-Napoca, Romania.

Based on the disclosure by the European Commission from the year 2018 and the “Plastics 2030 Voluntary Commitment,” it is of foremost importance the relinquishment of fossil resources and the application of bio-based and biodegradable materials in plastic manufacturing [1]. Itaconic acid (IA) is a profitable platform chemical, part of the US Department of Energy’s top twelve building block list that can be obtained from renewable biowastes or biomass. The present review aimed to analyze the current state of bio-based polymer production from this bulk chemical and its biodegradability. IA is mainly produced through fermentation with the fungi *Aspergillus terreus*; thus, it presents a suitable replacement for fossil-based materials. Its trifunctional structure allows the formation of innovative biopolymers and hydrogels with various utilizations. It can be implemented successfully in hydrogels in water treatment, in the pharmaceutical industry as controlled and targeted drug delivery nanocomposite or antimicrobial polymer in wound healing. IA can also be efficiently integrated into intelligent/active food packaging with biodegradable properties to extend shelf life in the food industry. Besides sustainable development, these biopolymers have to fulfill the market needs and life-cycle assessments.
Acknowledgment: This research was funded by the Internal Project of the University of Agricultural Research and Veterinary Medicine of Cluj-Napoca, applicative research grants nr. 21683/01.10.2021.
Reference:1. Hatti-Kaul, R.; Nilsson, L.J.; Zhang, B.; Rehnberg, N.; Lundmark, S. Designing Biobased Recyclable Polymers for Plastics. Trends Biotechnol. 2019, 1789, 1-18, doi:10.1016/j.tibtech.2019.04.011.

B2.2
Active packaging - PVA biofilms with biopolymers

***R. Varvara**, D. Vodnar, K. Szabo;*
USAMV - University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca , Romania, Cluj-Napoca, Romania.

Food packaging is designed to maintain the quality and safety of food during transport and storage. Plastic packaging meets these requirements, but has a significant impact on environmental pollution.The aim of this study was to obtain a biodegradable, economical and edible packaging that acts as an antibacterial barrier on the surface of food. The active biofilms were prepared from polyvinyl alcohol (PVA) with the addition of itaconic acid (IA)

and chitosan (Ch), and enriched with extracts from tomato by-products (TBE). The physical and antimicrobial properties of the two biopolymers (Ch, IA), were studied, but also of the tomato extract (TBE) - rich in carotenoids and phenolic compounds. TBE-containing samples showed an improvement in physical properties (diameter, thickness, weight, density) compared to control biofilms (consisting of PVA + Ch, respectively PVA + IA). TBE and Ch provide biofilms with antibacterial effects, the best inhibition was against S. aureus and P. aeruginosa, with a minimum inhibitory concentration (MIC) of <0.078 mg DW / mL. Moreover, PVA and IA films have antimicrobial activity against P. aeruginosa (2.5 mg DW / mL). The total phenolic content was determined by the Folin-Ciocâlteu method, and the PVA-Ch-TBE samples presented the highest values. These results indicate that PVA-Ch-TBE films can be used to develop active biofilms systems suitable for food packaging.

POSTER PRESENTATIONS

Climate-smart agriculture and food security

B3.1
Drying process improvement of a cacao beans hybrid solar dryer

***E. Duque Dussán**, J. Banout;*
Czech University of Life Sciences, Prague, Czech Republic, Prague, Czech Republic.

Cacao producers usually face a complex situation when drying their product using open sun drying processes, considering that this drying method is highly affected by the weather conditions. Achieving a final bean moisture content between 6 and 8% (w.b) will lower the possibilities of bacteria, fungi and other microorganisms growth along with a high storage and bean quality. However, because of the approximate initial bean moisture of 70% (w.b), and due to the method's dependence on the variating tropical climate, it can take up to ten days in the best case, threatening the product's integrity. This is why different solar drying units and technologies have been developed, seeking to reduce the bean's drying time and quality preservation; one of the most important technologies is the so-called hybrid solar dryer, which uses a collector to heat the ambient air which is afterwards travelling across the dryer's domain. The connection between the collector and the drying chamber is usually laterally arranged at the collector's inclination; however, a new system was designed with an air inlet at the bottom of the unit, vertically arranged to compare the drying air behaviour and velocity and distribution both dryers. After performing a Computational Fluid Dynamics (CFD) simulation, it was seen that the new proposal allows the air to distribute homogeneously and keep a high velocity, facts that will impact the drying process positively. Based on these results, the process was also simulated numerically, obtaining both units theoretical drying time, where the new proposal displayed a significant time decrease. The drying performance was improved, being translated as a potential upgrade of the process, directly impacting its efficiency and production outputs.

B3.2
Acclimatization potential of fall armyworm in Croatia

***M. Kadoić Balaško**, M. Zlodi, R. Bažok;*
University of Zagreb, Croatia, Zagreb, Croatia.

The fall armyworm (*Spodoptera frugiperda*, J. E. Smith) has become an important invasive pest worldwide. For a long time, the pest was found only in North and South America, where it is considered an economically important pest of crops. In January 2016, it was first observed in West Africa. Within two years, fall armyworm has spread across almost the entire African continent and then spread further to Asia and Australia. Due to the extremely rapid spread of fall armyworm in the last four years, it is feared that the pest could reach Europe very quickly. Considering its great ability to migrate long distances, there is a possibility that it flies from North Africa to Europe every year. Here we present the biological and ecological characteristics of fall armyworm and the damage it causes. The current status in the world is presented and the possibility of acclimatization in the areas of southern Croatia (Metković) and eastern Croatia (Gradište) is determined. Meteorological data were collected from each station for the period from 2010 to 2020. The suitability of the area was determined by calculating the sum of effective temperatures required for the development of a generation (thermal threshold 10.9 °C, the sum of 559 °C mean daily temperatures above the threshold and monthly precipitation below 100 mm). The analysis of meteorological data and their comparison with the requirements of the pest has shown that acclimatization of the fall armyworm in Croatia is not possible, but due to the favorable conditions in summer and the proximity of areas where this pest can successfully survive, there is a risk of seasonal migration to Mediterranean areas (Metković). Moreover, given the ongoing climate change, it is very likely that this species will adapt quickly, invade new areas and become a problem.

B3.3
Adoption of climate change adaptation strategies among maize farmers in Nigeria

***O. A. Olasoji**, M. Bavorova;*
Czech University of Life Sciences, Prague, Czech Republic, Praha, Czech Republic.

The world’s population is growing at an exponential rate putting more pressure on agricultural productivity. It is expected that by the year 2050, there would be 3.5 billion more people in the world to feed. To meet up with the ever-growing demand, agricultural production is expected to increase. However, all over the world, the climate is changing and negatively influencing agricultural productivity due to changes in temperature and rainfall patterns. To cope with these changes and the adverse effects that accompany them, farmers need to adapt. This study was conducted to identify the factors influencing the adoption of adaptation strategies among maize farming households in Oyo State, Nigeria. A total of 197 respondents were interviewed for this study. About 85.8% of the respondents claimed that they were highly concerned about their future as farmers. About 58.4% of the farmers believe that rainfall patterns have become unpredictable while 62.9% of the respondents believe that the average temperature has increased. The most practiced adaptation strategy was mixed cropping (89.8%) while the least practiced adaptation strategy was conservation tillage (12.7%).The binary logit regression model was used to analyze the factors influencing the adoption of organic fertilizers, irrigation, cultivation of different crops, cultivation of improved cultivars and agroforestry adaptation strategies. The study showed that marital status, age, respondent as household heads, off-farm employment, years of farming experience, the use of family labor, farm distance to the market, cooperative membership, access to credit, access to weather information, the practice of contract farming and information sourced from research institutes, friends and family were statistically significant and influenced the adoption of adaptation strategies. It is very important for farmers to improve their adaptive capacities. This way they can cope better with the adverse effects of climate change. The government and research institutes also have important roles to play in enabling the farmers to cope with the adverse effects of climate change. Keywords: Climate Change, Adaptation Strategies, Maize, Farming Households, Binary Logit Model

B3.4
Monitoring winter wheat growth and development through different climate change scenarios

***S. Skendžić**, D. Lemić, H. Novak, V. Lešić, M. Ratković, J. Tabak, M. Polić, M. Orsag, M. Zovko;*
University of Zagreb, Croatia, Zagreb, Croatia.

Global climate change, including increasing atmospheric CO_2 concentrations, temperature rise, and variable precipitation patterns, is expected to have significant impacts on the development and production of many agricultural crops. Winter wheat (*Triticum aestivum*, L.), one of the world's most

important crops that plays a major role in the global economy and food security, is one of the crops most affected by climate change. Climate warming has significant impacts on winter wheat development, which in turn leads to yield losses, mainly due to shortened phenological events associated with reduced assimilate production, and biochemical irregularities. The intensity and duration of warming trends and heat waves are expected to be even more extreme in the future than today, resulting in even greater production losses. In this context, appropriate adaptation measures may be needed. Therefore, it is important to better understand how wheat growth and development are changing and how they might be affected by additional stresses due to climate change in the future. The main focus of this scientific work is to monitor winter wheat growth and development based on different climate change scenarios using an Iot-based encapsulated design system. The proposed system provides equipment that can be used to rapidly conduct a series of different crop experiments simultaneously in a climate-encapsulated chamber system with an extensive network of climatic sensors and using multispectral cameras. These sensors are connected to the central database in a computer cloud, which serves as a repository for climate data that can further be correlated with plant identifiers collected by the multispectral cameras. Simulations of two different climate change scenarios as proposed by the IPCC group (global temperature increase from 0.3 to 4.8 °C by the end of the 21st century) are artificially generated and implemented in a prototype climate chamber where winter wheat plants are grown. Changes in winter wheat development at different phenophases will be monitored using multispectral cameras. Plant development will be presented in terms of vegetation indices (NDVI, PRI, SR, GNDVI, SAVI, etc.), which will provide indirect measurements of biophysical parameters such as biomass, LAI, plant height, and biochemical parameters such as plant pigment and water content.

Global trends and challenges in animal husbandry and veterinary medicine

B3.5
Lohmann Brown rooster semen: intrinsic bacteria and their impact on sperm progression and seminal biochemical parameters

***M. Duracka**, M. Petrovičová, M. Lenický, F. Benko, A. Kováčik, N. Lukáč, M. Kačániová, E. Tvrdá;*
The Slovak University of Agriculture in Nitra , Slovak Republic, Nitra, Slovakia.

Although bacterial populations are natural components of semen, previous studies on livestock ejaculates have shown that the bacterial presence affects the spermatozoa quality as well as seminal composition. Our study aimed to define bacterial populations in rooster semen and to evaluate associations with the progressive movement of spermatozoa and biochemical parameters of the seminal plasma. For this purpose, semen samples from Lohmann Brown crossbreed roosters (n=27) were collected from a breeding farm near Nitra (Slovakia). Progressive movement (PRO) and concentration of spermatozoa was analysed using the computer-aided semen analysis (Hamilton-Thorne Biosciences, Beverly, MA, USA). Sterile water-diluted fresh semen was cultured on blood and Tryptone soy agar (both purchased from Oxoid, Basingtoke, UK) during 24 h at 36 ± 2 °C under aerobic conditions. Following the cultivation, bacterial colonies (CFU) were counted, isolated and subjected to bacterial identification using the matrix-assisted laser desorption/ionization - time of flight mass spectrometry (MALDI-TOF MS Biotyper, Bruker Daltonics, Germany). Seminal plasma was separated and following biochemical parameters were assessed using Randox RX Monza biochemical analyser: Calcium (Ca), Magnesium (Mg), Phosphorus (P), Triglycerides (TG), Cholesterol (CHOL), Creatinine (Cr), Alkaline phosphatase (ALP), Alanine Aminotransferase (ALT), Bilirubin (BIL), Uric acid (UA), Urea, Total proteins (TP) and Albumins (ALB). The obtained data was subjected to the Pearson correlation analysis. Moreover, samples were evenly divided into 3 quality groups according to the percentage of progressively moving spermatozoa. The high quality (HQ) group was defined with PRO > 56%, the intermediate quality (IQ) with PRO oscillating between 43 and 56% and the low quality (LQ) group with PRO < 43%. Differences between the quality groups were evaluated using one-way ANOVA followed by the Tukey multiple-comparison test. The results showed that the presence bacterial colonies were positively correlated (r=0.678; P<0.001) with the sperm concentration and negatively correlated (r=-0.541; P<0.001) with progressive motility of spermatozoa. The CFU value recorded significant negative correlations with Ca, Mg, Cr, ALP, ALT, UA, ALB (P<0.05) and TP (P<0.01). The comparative analysis showed significantly higher CFU in the IQ group (P<0.05) when compared to HQ, while the LQ group was characterized by the highest CFU value, significantly higher when compared to HQ (P<0.01) and IQ (P<0.05). At the same time, the LQ group recorded the highest sperm concentration, significantly higher when compared to HQ (P<0.05). Bacterial identification showed the presence of species coming from *Enterococcus, Escherichia, Corynebacterium, Pseudomonas, Ochrobactrum, Alcaligenes, Staphylococcus, Serratia, Rothia* and *Pantoea*. The bacterial biodiversity in the quality groups increased with decreasing progressive motility of spermatozoa (HQ < IQ < LQ). Overall, our study reveals a deteriorated sperm progressive motility in highly contaminated rooster ejaculates. Moreover, the biochemical parameters of seminal plasma differed amongst the quality groups, while TP, Ca, Mg, UA, ALP and Cr showed worsened values in LQ group when compared to the remaining higher semen quality groups. This study was supported by the Slovak Research and Development Agency under Grant no. APVV-15-0544 and the Scientific Grant Agency under Grant no. VEGA1/0239/20.

Environment in the context of climate change

B3.6
Cultivation of tomatoes in the conditions of climate change in the Elbe lowland, Czech Republic

***N. Muntean**;*
Czech University of Life Sciences, Prague, Czech Republic, Prague, Czech Republic.

Providing people with affordable and cheap food is a serious task for agricultural producers that at present suffer from the impact of climate change. Climate change has a negative influence on the growth of crops, traditional for some regions, but at the same time, the increase of temperature in some countries creates the possibility for the extension of the cultivation areas for thermophilic vegetables. For a better understanding and evaluation of climate change impact on the possibility of the extension of the cultivation areas for thermophilic vegetables in the open field, was performed present research work. The practical part of the research was realized with thermophilic crops that are in the present grown infrequently in the lowland area of Elbe river but can become in the nearest future important and often cultivated thanks to climate change. The Thomas F1 variety was used for the research that is an indeterminate tomato cultivar, able to generate high economic returns, especially for small landholders. The crops were planted on experimental lots in the open field, which helped to determine the suitability of the cultivated area of the region for efficient cultivation. During the whole vegetation period, the samples of plants were collected, at regular intervals of time, with measuring of necessary parameters in order to determine Leaf Area Index (LAI) and Above Ground Biomass (AGB) from transplanting to harvest. We accumulated important data, obtained in the frame of the permanent monitoring and careful record (meteorological data, the humidity of the soil, the solar radiation, etc.), necessary for the theoretical part of the research, related to the creation of the simulation model of the tomatoes growth from planting to harvesting. In the frame of the studies was created and calibrated the CROPGRO-Tomato model, included in the Decision Support System for Agrotechnology Transfer (DSSAT) software, for the Thomas F1 indeterminate tomato cultivar grown under open field conditions at two locations (Suchdol and Mochov) in the Czech Republic with different soil and climate conditions A good agreement between simulated and measured LAI and model performance statistics indicates that the LAI had been calculated accurately during the CROPGRO-Tomato model calibration. The model showed exhibited the highest LAI prediction accuracy. The leaf area development was compared, and although the modelled values were higher than the measured values, they were still within a reasonable range. The model has shown an acceptable range of variations. The elaborated simulation model permitted to determine expected growth and development of the crop, based on equations that describe the crop's responses to the specific soil and weather conditions.

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B3.7
Small scale landfills as a sustainable waste management solution for rural areas in Moldova

K. Mareš[1]*, D. Marešová*[1]*, A. Furculita*[2]*;*
[1]Czech University of Life Sciences, Prague, Czech Republic, Prague, Czech Republic, [2]State Agrarian University of Moldova, Chisinau, Czech Republic.

Waste management in Moldova require investments in infrastructure and new treatment facilities. Nowadays, services in municipalities vary mainly according to size. In big cities as Kishinev overall 60 - 90 % of waste is collected and treated, in some rural areas WM services exist, but are not frequently used. In most settlements those waste services are not provided at all. In average only 6 % of waste in rural areas are collected and treated. Most of the household waste is treated by landfills, which are main source of water/air/ground pollution because of poor infrastructure, unsanitary conditions, and operations. Recycling technologies are very limited. Source separated collection or post-collection sorting is not practiced. Detailed mapping of current situation in waste production and handling in Moldova is needed. In rural areas, basic sanitary criteria should be met in transportation and treatment of municipal solid waste. Small-scale sanitary landfill for rural areas represents sufficient solution for MSW treatment with lowest price and meeting sanitary condition for environment and human health. Propose of small-scale landfill meeting basic sanitary criteria. Small scale solution could meet individual requirements of local authorities and local condition (area, size 3-5 ha, composition of waste). Case study will establish small scale landfill on existing spot of open dump near small municipality. Excavator will prepare the surface of landfill, summarize the original shipped waste. Free space prepared by excavator will be sanitized and filled out by impermeable foil as a bedding of landfill. Recyclable waste should be sorted in that time, organic not polluted waste should be moved on proper place for organic waste. Incoming waste will be pre-sorted (If possible), recyclable waste should be located in containers designed to transport this waste into recycling centres, gained money should help to run the landfill operations.

Sustainable agriculture and forestry

B3.8
Reconceptualization of research methodology in the field of optimization of soil moisture regimes

A. A. Coronovschi*;*
State Agrarian University of Moldova, Chisinau, Moldova

The paper presents a reconceptualization of the research methodology in the field of optimizing soil moisture regimesThe main mistake in the field of irrigation research is that the soil, as the main object of hydro-improvement, is accepted only as a storehouse of nutrients necessary for the high yields of agricultural production. That is why it is understandable that such an approach to the problem excludes the ecological treatment of the solification processes.That is why the issue of improvements needs to be approached from the point of view of Dokuceaev V.V., [1952] namely the factors of solification. Later on, this issue was developed by the American researcher Ienni E [1948], who tried, on the basis of a large experimental material, to gain different correlations between ecological factors. With this in mind, it is necessary to address the problem of hydro-improvements (soil hydrothermal regime) with the help of new methodologies and ecosystem analysis, and the focus should be on the factors of solification and the impact on them of land improvements (in this case of hydro-improvements).In view of the above, we come up with a new methodology for optimizing irrigation regimes, based on reducing or minimizing the negative ecological impact on the hydro-physical and chemical properties of the soil and maintaining the direction of solification processes within their natural limits.It is hypothesized that the optimal level of CO2 (maximum level) can be accepted as a biological indicator against which to perform the process of optimizing humidity.In this case, to confirm the hypothesis, it is necessary to meet the conditions in which the variant with maximum CO2 production must have a maximum:1. Productivity of agricultural crops.2. Potential soil fertility.Research results confirm that:1. The initial hypothesis that CO2 production can be accepted as a biological indicator for optimizing soil moisture regimes during irrigation is confirmed.2. The current methodology of soil moisture research and optimization does not meet the existing ecological requirements, reducing the possibilities for researching the entire field of moisture that can be maintained in the soil.3. It is observed that as the soil moisture level increases higher than variant 2, the difference between the variants decreases. This effect leads to the idea that soil moisture higher than that of variant 2 tends to inhibit microbial activity and decrease the intensity of solification processes.4. The results of this research may not be valid for other climatic regions.

B3.9
Integrating ecological impact indicators into economic restructuring decisions

S. Movahhed Moghaddam*;*
Czech University of Life Sciences, Prague, Czech Republic, Prague, Czech Republic

Establishing a foundation for policy-making to address sustainable development needs multiple tools and integrating sets of ecological, social and economic indicators into development planning. What is considered in literature as a study gap is, how to integrate the ecological impact criteria into economic development decisions. This is important especially in the context of the restructuring of economic structures in response to natural resource constraints such as water, as well as countries ‘commitments to reduce greenhouse gas emissions (GHGs). To this end, we used an integrated mathematical programming and environmentally-adjusted input output methodology. The results showed in terms of stimulation to economic growth the role of industrial activities compared to agriculture and services sectors is more prominent in the economy so that Food and beverages and the Communications equipment sectors have the highest forward and backward linkages, respectively. In terms of water use results are different in a large extent so that the Crude petroleum and natural gas and mining industries as well as services sector have higher priority. Highest water footprint belongs to agricultural sub-sectors that consume more than 90% of the country's water resources. Highest CO2 footprint among different economic activities belongs to the transportation, industrial activities and Livestock sector. The results of integrated ranking of economic sectors including the weight of each of the three objectives (maximizing production value, minimizing CO2 emission and water consumption) based on policy makers' opinions showed that generally agricultural sub-sectors activities have lower position compared to the industrial and service sectors. This result is unlike the policy orientations of development planning in the past in which agricultural sector was considered as a key sector of development in Iran. Based on our findings, to achieve a sustainable economic structure a trade-off is needed between different objectives and the emphasis should be on the development of sectors which have higher economic multipliers while having lower water and CO2 emission footprints.

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