CASEE CONFERENCE
2021
"CASEE universities as laboratories for new paradigms in life sciences and related disciplines"

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Book of Abstracts

CASEE
Central and South Eastern Europe

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Foreword of the ICA-CASEE president

Prof. PhDr. Michal Lošťák, Ph.D.

Dear participants of the 11th CASEE conference, dear readers,

Since 2010 the members of CASEE universities always had the possibility to meet face-to-face during annual CASEE conferences. We discussed interesting and challenging issues in Vienna, Gödöllö, Cluj-Napoca, Zagreb, Novi Sad, Nitra, Timisoara, Warsaw, Bucharest, and Sarajevo. In 2020 the venue was planned for Prague. However, the COVID-19 pandemic disabled to organise this conference, and the meeting was postponed till 2021 with great hope to be together on the campus of the Czech University of Life Sciences Prague. Nevertheless, the circumstances were not favourable to meet face-to-face again. Therefore, the CASEE board decided to organise the 11th CASEE conference named "CASEE Universities as laboratories for new paradigms in life sciences and related disciplines" in an online form. Such a form of our conference is a novelty in CASEE activities. Being exposed to such a challenge we decided to continue wording in the title of the conference – namely the reference to laboratories. Like in the laboratory, we started to think about some experiments echoing the novelty of our conference format. Therefore, also the plenary session was designed to be unusual. Keynote speakers will address the science done by CASEE universities in general. What are the areas of our excellence in research implemented by CASEE universities, where might we cooperate in research, what does it mean to be an excellent scientist? They are the questions addressed by the plenary session. They are supposed to be continued by the discussion of the conference participants. The last activity is an attempt to encourage social interactions – an element so missing when introducing measures aiming at combating the COVID-19 pandemic. The fact that we organise this conference in an online format and we have many participants, as documented by this Book of abstract, symbolises CASEE universities cope with the COVID-19 pandemic in the most appropriate way.

This Book of abstracts highlights the main idea of the oral presentations and posters presented during this conference. I am very thankful to Libuška Mercl, Lukáš Pospíšil and Petr Cihelka from Czech University of Life Sciences Prague, just to mention the persons who were behind the organisation of this event. It was not easy because such a form of the CASEE conference had never been implemented before. Their support and activities together with 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 COVID-19 did not interrupt it. This year the conference is conducted in 6 working groups/sessions: (1) Bioeconomy (renewable resources – opportunities and constraints), (2) Environmental safety and climate change, (3) Modern agriculture (new challenges in plant and animal sciences, biotechnologies), (4) Sustainable food systems and quality, (5) Sustainable food systems and quality, and (6) Rural development (including landscape planning) and rural economies. I hope all participants will enjoy this conference and will gain experience with another conference format underpinned by ideas about research at CASEE universities.

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Annotation

In the following we are publishing
the abstracts as submitted by the authors.

ORAL PRESENTATIONS

Oral session 1: Bioeconomy (renewable resources - opportunities and constraints)

1a.1
Almond, hazelnut and walnut shells as solid biofuels - biomass and biochar valorization

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Biomass is one of the promising raw materials for the production of renewable energy which can be a partial replacement for fossil fuels. The generation of agricultural and industrial residues, as valuable biomass resources, is increasing each year. Their utilization for energy generation and value addition by thermochemical biochemical processes may replace a portion of conventional energy sources for fuel and energy. Typical methods used for the conversion of biomass for energy purposes is the thermochemical method. Pyrolysis is a thermochemical process that is carried out in the absence of oxygen and from which we can produce three different products: bio-oil, biochar and synthetic gas. Biochar is one of the pyrolysis by-products and it can be used as a raw material for energy production. Scarce research has been conducted on almond, hazelnut and walnut shells; hence, there is a need for a more detailed analysis of their potential. The objectives of this study were to determine (I) the almond, hazelnut and walnut shells biomass energy properties (structural, ultimate and proximate analysis, heating values and the content of macroelements) as feedstock in the process of pyrolysis (II) percentage share and the energy properties of biochar as a potential raw material for combustion and co-combustion (proximate analysis, higher heating value and the content of macroelements). Ash with moisture is a fundamental component of the non-combustible matter and 2,6% share is larger than in forest biomass but still better than in the most agricultural biomass. Of the combustible matter, the most significant components are carbon and sulfur, and the established values of 47% and 0.2% indicate the quality of the raw material. The structural composition indicates the potential for use in the production of liquid fuels but also in the production of solid fuels. The lower heating value ranged from 16 MJkg^{-1} (walnuts and almonds shell) to 20 MJkg^{-1} (hazelnut shell). The biochar percentage share of studied shells ranged between 30,29% (walnut shell) and 31.08% (almond shell). Compared to the feedstock, the pyrolysis process had a positive influence on biochar by increasing the high heating value (around 29 MJkg^{-1}), fixed carbon, and coke, but also a negative influence due to an increase of ash content (around 4%). Based on the research conducted on direct combustion and pyrolysis of almond, hazelnut and walnut shells, it can be concluded that investigated shells have good potential as raw materials for direct combustion. They have significant potential in the process of pyrolysis, ie the production of biochar as an energy source and as an added value product. Comparing the results obtained with biomass composition and biochar composition as a pyrolysis product, almond, hazelnut and walnut shells are a quality raw material for the production of solid biofuels.

1a.2
Polyphenols as prebiotic substrate for intestinal microbiota

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Introduction: Modulation of the intestinal microbiota is an important factor through which health can be improved. A balance between moderate consumption of prebiotics and probiotics can play a decisive role in gut health. Over the last years, prebiotics gains attention in order to improve intestinal microbiota health, and in 2015 it has been approved new classes of substances classified as prebiotics. Polyphenols are one of them and in addition to their role as a prebiotic substrate, they can have many other benefits for human health, such as antioxidant, anti-inflammatory, anti-diabetic anti-cancer, neuroprotective, anti-adipogenic.
Scope and approach: This work aimed to investigate the role of polyphenols as prebiotics correlated with various health issues. Dietary polyphenols are compounds present in food like fruits, vegetables, cereals, wine, cacao, tea and coffee, and many other types of foods derived from them. After ingestion, they are perceived as xenobiotics and they have low bioavailability, firstly are absorbed in a small quantity in the

small intestine, and the majority of them reach the large intestine. There are studies that prove, that after they reach the gut microbes, they have the ability to influence the intestinal ecology, through their prebiotic effect and the antimicrobial action. Polyphenols are transformed by the intestinal microbiota into bioactive compounds with many benefits, such as inhibition of certain bacterial groups and increasing in the available niche of the ecosystem.

Methods: A systematic search of the literature was taken in the following databases: Web of Science, Science Direct, PubMed, Google Scholar, and Scopus.

Conclusions: Polyphenols are a class of substances that has attracted a lot of attention lately and there is evidence from preclinical and clinical studies that prove their benefits in various diseases, and the most important, their impact on gut microbiota. The most advanced strategies have improved by developing ways to transport polyphenols in the gastrointestinal tract and targeting intestinal regions, to overcome their low bioavailability.

1a.3

Targeting novel diet therapies: psychobiotics in the management of major depressive disorder

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Introduction. One of the greatest advances in the field of gastroenterology and psychology in the past decade is the confirmation that there is indeed a complex communication system between the gastrointestinal tract, the microorganisms which inhabit it and the peripheral and central nervous system. Researchers have found that there is a constant change of information from the periphery to the brain and back which is conducted *via* the microbiota gut-brain-axis. As a result of recent vast probiotics research in the field of psychiatric practice, the term psychobiotics has been introduced and refers to probiotics, health beneficial bacteria, and prebiotics, support for such bacteria, that when ingested in adequate amounts exert a mental health benefit on the host.

Aims The aim of this narrative review is to summarize different mechanisms by which gut microbes are able to govern the functioning of host brain and implication of these mechanisms in development and alleviation of depressive disorders and to see how different product formulations including matrixes and dosage forms can contribute to these effects.

M**aterials and Methods** This research work is based on multidisciplinary domains from literature comprising significant numbers of research articles gathered in this study with main focus on the potential correlation between the pharmaceutical formulation/food matrix of various psychobiotics and the observed effect in depressive subjects.

Results In this field of research, literature data of human investigations is currently limited. Evidence gathered on psychobiotic research is based on rodent models and they indicate that animal behavioral responses are impacted when gut flora is manipulated.

Conclusion To our knowledge, this is the first paper which endeavors' to corelate the relationships between bacterial strain, therapeutical dose, commercial formulation and desired health effects. Despite the limitations, these current findings may be considered a promising aspect of further research in the field of novel therapies for major depressive disorder and other psychiatric disorders.

1a.4

Residential and working neighborhoods with a focus on circular economy: case study Guatemala City, Central America

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Guatemala is situated between the Pacific Ocean and the Caribbean Sea, bordering the countries of Mexico and Belize to the north and northeast, and Honduras and El Salvador to the southeast. Guatemala City lies

centrally in the southern portion of the country. Many low-income people live within the city and are concentrated into 22-specific neighborhood zones where each characterizes the social and economic classes; Zone 3 being the most impoverished. This research reports on a successful project aimed at providing livable-wage jobs for disadvantaged youth from the Zone 3 neighborhood. But what would be the requirements for establishing such a business that also embraced the key principles of circular economy? This venture proposed developing a municipal composting business using the organic waste generated by a large central fruit and vegetable processing market. This market sends 114.7 cubic meters of organic waste to the landfill daily. The greenhouse gas emitted from this waste leads to cancer and tumors among the working class where laborers have little or no access to basic health care. This research project explored the following questions: could usable compost be made from the organic waste rather than adding it to the landfill? What were the requirements involved in making compost in the challenging climatic conditions of Guatemala City which is situated high in altitude and experiences periods of extremely dry and hot temperatures during portions of the year and heavy rainfall and near freezing temperatures at other times? If successful, could this effort create jobs and train workers from the Zone 3 neighborhood, thus becoming a model for circular economic jobs creation while adhering to the pillars of sustainability, with an emphasis upon social sustainability? And finally, could one employ university students as planners, designers, and managers of such a venture as part of their educational curriculum?

1a.5
Organic acids biosynthesis by lipophilic yeast strains from agroindustrial by-products

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Introduction: Organic acids such as citric and succinic acids are well-known bulk chemicals with food industry applicability that are produced in massive quantities worldwide, and are obtained particularly using microbial fermentations. Both citric and succinic acids can be synthesized in large amounts by specific yeast strains from industrial wastes, like crude glycerol that results from biofuel manufacturing. Most Yarrowia and Candida species grow efficiently on glucidic and fat substrates, and, at the same time, biosynthesize valuable organic acids like citric and succinic acids.
Aims: The present work aims to assess the ability of Candida zeylanoides to use agro-industrial wastes like used cooking oil as the main nutrient source in the production of citric and succinic acids.
Materials and methods: The experimental work consisted of used cooking oil fermentation at lab scale bioreactor, at a constant temperature, rotations, and pH. The yeast cells' viability, substrate consumption, and organic acids production were monitored throughout the experiment.
Results: The adaptation capacity and the growth of C. zeylanoides cells in media containing used cooking oil was noticeable. Important results concerning the microbial bioconversion of used cooking oil into citric and succinic acids were registered.
Conclusion: Agro-industrial wastes such as waste cooking oil derived from the food sector represent a valuable source of nutrients for yeast strains like C. zeylanoides, which can further bio-synthesize important chemical compounds such as citric and succinic acids.

Oral session 2a: Environmental safety and climate change

2a.1
Urban environmental challenges and management facing Amman growing city

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There is an international concern on addressing the implications of environmental risks and climate change on urban areas all over the world cities, with a conscious attempt to respond more quickly and more effectively to minimize the associated consequences and dangers. The aim of Urban environmental management is to keep pace with the adverse impacts of rapid urbanization, economic, and population growth. This method proved to find and measure the impact of the built-in environment on the whole environment (Ghosh, 2003). Environmental management of Amman city with regards to the substantial increase in urban growth has witnessed several positive transformations which included urban planning, establishing institutions, regulations, laws, and setting mitigation measures and action plan to absorb that negative impacts (Alnsour, 2016).
The main thrust of this paper is to set out to document the existing situation and evaluate it by providing an overview of the foremost environmental challenges of urbanization that Amman city tackling, and Particular attention is focused on the adopted mitigation measures and environmental protection expenditure that aid to overcome these challenges and considered as an indicator to measure the efforts of public institutions toward the environment and enhance the quality of life of city residents. This paper also reviews and presents the literature of environmental urban management at Amman city for coping with environmental risk challenges and the importance of urban planning and initiatives for the wellbeing of the citizens and for the environmental sustainability of the city we live in. For instance, Amman is the first Arab city that adopts a Climate Plan to tackle environmental concerns such as inefficient land use and also the price of imported energy.
Suggestions and recommendations had also presented in this study that should be taken into consideration to succeed in a sustainable resilient city approach. One of the important recommendations that the study revealed is the need for tools and methods to evaluate and assess the city for the best identification of the most effective measures to increase the environmental management of Amman's urban city. This assessment will initially contribute to the process of policy formulation and urban planning work for Amman's city.

2a.2
Soil CO$_2$ emissions from burning slash piles in a Mediterranean rural area (Croatia)

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Burning slash piles is very often used by land managers in the Mediterranean rural areas. These methods are preferred because they allow the removal of large quantities of unwanted biomass in a controlled environment. However, carbon released during biomass burning contributes to atmospheric loading of greenhouse gases and demands additional research about soil CO$_2$ emission. To supplement this issue, two experimental pile burns, on March 18th 2019 were established in the Mediterranean part of Croatia. The study area is located in the rural area, near Vrana settlement (43°58'N 15°31'E; 20 m a. s. l.), with a slope of ~18°, southwest aspect, and soil type classified as *Leptosols*. Moderate severity burn (MS) was filled with 10 kg m^{-2} barley straw, and high severity burn (HS) with 10 kg m^{-2} barley straw and 15 kg m^{-2} vine stem. Unburned treatment (UB) with natural vegetation; meadow plants (*Foeniculum vulgare* Mill., *Elymus repens* (L.) Gould, *Digitaria sanguinalis* (L.) Scop.), and the Maquis shrubland was established to assess the impact of both burn treatments. One treatment covered 10 m². Soil CO$_2$ emissions together with meteorological conditions were measured around midday over 1-year period; immediately after burn (IAB), 1 months after burn (1MAB), 3MAB, 8MAB, and 12MAB on each treatment. Additionally, vegetation cover (VC), soil moisture (SM), soil temperature (ST), total carbon (TC), total nitrogen (TN), C:N ratio, and soil organic matter (SOM) were determined. UB treatment had lower soil CO$_2$ emissions than both burn treatments, and didn't vary significantly during the study period (4.19–11.34 kg ha^{-1} day^{-1}). However, burning

slash piles significantly increased soil CO_2 emission at HS (35.65 kg ha^{-1} day^{-1}) IAB, and (26.25 kg ha^{-1} day^{-1}) 1MAB. Conversely in the context of MS, the significantly highest soil CO_2 emissions were noted 8MAB (23.65 kg ha^{-1} day^{-1}), 1MAB (20.94 kg ha^{-1} day^{-1}), and IAB (18.56 kg ha^{-1} day^{-1}), respectively. Overall, soil CO_2 emissions were significantly decreased with VC (r=–0.62), and ST (r=– 0.39), and increase with SM (r=0.41). No significant correlation was found between soil CO_2 emissions and TN, TC, C:N ratio, and SOM content, which can be explained by ash influx in the soil. It is assumed that relative rapid vegetation regrowth contributed to decreasing soil CO_2 emissions at both burn treatments, as the emissions equiponderated after one-year study. Altogether, it can be concluded that MS and HS contribute to atmospheric loading of CO_2 emissions, however due to their relatively small burned area, their impact is not notable on the global scale of loadings of greenhouse gasses.

2a.3
Possibilities of plant use and food waste on remediation of degraded land

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According to the Polish law, every industrial site after the discontinuation of exploitation activities should be recultivated. Currently, there is a search for appropriate and environmental methods that will make it possible to restore the old glory of post-industrial areas in an accelerated manner. As an answer to the growing threat to the quality of health and the quality of the environment, a number of remediation technologies for contaminated soils have been developed. Cleansing the soil with thermal, chemical or electrolytic methods (hard technologies) may be associated with the destruction of biological life, loss of organic matter or changes in the way it affects living organisms. An interesting alternative to the mentioned above technologies are biological methods (phytoremediation), characterized by lower costs and lack of adverse impact on the soil. Phytoremediation systems utilize the potential of the natural or actively managed soil-plant system to detoxify, degrade and inactivate potentially toxic elements in contaminated soil. Using food waste (FW) compost for assisted phytoremediation is an innovative and attractive technique that integrates waste utilization and recycling, moreover the waste loop is closed. Well stabilized compost promotes plant growth and thus its use can contribute to the effectiveness of phytoremediation.In this study, we evaluated the effect of FW compost on phytoremediation of contaminated soil from a site of the Warsaw sewage pumping and pumping station manufacturing facility, where process by-products were stored in addition to the manufacturing itself. Soil was taken from 5 different locations on the site, starting from the most to the least contaminated locations. The first stage of the study was to test how selected plants (Sinapis alba L., and Hordeum vulgare L.) with and without the addition of compost at concentrations of 20% and 50% develop on the metal-containing soil. The second step was to use the analytical technique of Atomic Absorption Spectrometry (AAS) to determine metals in soil samples. Through AAS, the phytoextraction and phytostabilization ability of some plant species was also evaluated. The conducted experiments have shown that only appropriately selected doses (relatively low) of compost with FW will support plant growth and simultaneously increase phytoremediation. In the case of soils with a very high amount of metals, plant growth processes practically do not occur, so it is necessary to find technical methods that will restore the former glory of the objects.

2a.4
Individuals' personality and the use of ridesharing in Germany

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The sharing economy has a growing economic and environmental importance. Sharing economy services in regard to ridesharing, e.g. Carma, Sidecar or BlablaCar become very popular in the last few years as more people begin to use them. Unlike ride-hailing services such as Uber or Grab, ride-sharing has the

primary goal to achieve higher vehicle utilization rates and decrease costs, but also to reduce emissions, as the driver was already planning to drive from A to B. Nevertheless, people also choose not to use this sustainable transportation mode due to different reasons e.g. perceived risk or inconvenience.This paper analyzes the relation between individuals' personality and the use of ridesharing. We make on the one hand use of the Big Five personality traits: Openness to experience, Conscientiousness, Extraversion, Agreeableness and Neuroticism. On the other hand, we will measure the demographic data, the readiness and use of ridesharing as well as possible moderators to connect it to personality traits. Based on the different personality traits, the readiness and use of ride-sharing will be predicted. The model will be tested empirically by using survey questionnaire survey on people in Germany.Therefore in the first step, we construct a linear mixed model and use the personality traits and the demographic data as input factors to predict the probability for using ride sharing services. Our hypotheses are:

•H1: The higher the score for openness, the higher the probability for using ride sharing•H2: The higher the score for conscientiousness, the lower the probability for using ride sharing•H3: The higher the score for extraversion, the higher the probability for using ride sharing•H4: The higher the score for agreeableness, the higher the probability for using ride sharing•H5: The higher the score in neuroticism, the lower the probability for using ride sharing

In addition to the in-sample prediction, also an out-of-sample prediction will be performed in order to test the robustness of the model. In the second step the relation between personality traits and important attitudes regarding ride sharing services, e.g. risk aversion, networking aspect, financial aspect and environmental awareness will be analyzed. The aim is to understand the main motivations of different character types, regarding the big five model, when using or not using ride sharing. These findings can in turn be used to better address the different characters in the context of marketing measures in order to further increase the usage rate of ride sharing services.The paper makes important contributions to the discussion of efficient use of transportation resources to reduce environmental impact in a continuous sharing economy. Based on the results, stakeholders of ridesharing platforms can adjust their marketing strategies to address people with different personality traits. Moreover, we will give advice on how ridesharing platforms can improve their platforms to make it more appealing to the customer in regards to individual personality.

Oral session 2b: Environmental safety and climate change

2b.1
Response of growth and yield of *Physalis angulata* to arbuscular mychorrizal fungi and goat manure application in a high level of soil phosphorus availability under organic growing conditions

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Physalis angulata is an American native annual herbaceous plant that belongs to the family Solanaceae. It is widely distributed and introduced to tropical and subtropical regions worldwide. This species is often characterized as an invasive weed of crops, especially a host of the causal agent of tomato bacterial spot disease *Xanthomonas campestris* pv. *Vesicatoria*. Recently, the plant has attracted renewed interest used as a medicinal plant due to its bioactive compounds. Nevertheless, the cultivation of *P.angulata* is not as popular as *P.peruviana* (Cape gooseberry), especially in organic farming. Many researchers focus more on the high nutritional value and potential health benefits than production aspects, including the yield potential. Hence, we investigated the effects of arbuscular mycorrhizal fungi (AMF), goat manure (GM), and their interaction to the growth and yield of *P.angulata* in soil containing a high level of available phosphorus. Outdoor factorial container experiment was carried out using a randomized complete block design with six replications in Central Java, Indonesia. AMF and GM were applied in the soil with four levels of dose (0, 10, 20, 30 g plant-1) for both of them. The results showed that there was no interaction between AMF and GM neither to plant growth nor yield. The effects of AMF were not clear on plant growth (plant height, leaf and branch number, main stem diameter) and yield parameters (fruit weight, fruit number per plant, fruit diameter), although there was a significant difference between shoot dried weights. The effects of GM

mostly showed in the growth parameters at sixth weeks rather than yield parameters. The observed vegetative plant growth phase responses in several parameters were not reflected in the plant yield and vice versa. The fecund soil condition used might cause unbalanced soil fertility settings even amended by the application of AMF and GM where both have their characteristic in terms of providing extra nutrients for plants. Therefore, the application of AMF, either individually or in combination with GM showed different effects on the production of *P.angulata* depending on environmental factors, including the soil nutrient status, especially nitrogen and phosphorus.

2b.2
Diffuse reflectance spectroscopy and model analysis for assessing fire affected soil chemical properties in Croatia

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Wildfire impacts on soil chemical properties can be detected through spectral signature. Fire severity effects on soil can be assessed using proximal spectroscopy. This method is non-destructive and estimates several soil properties. The objective of this work is to 1) estimate and monitor the effects of wildfire on 11 soil chemical properties using visible and near infrared (VNIR) hyperspectral reflectance and 2) compare model performance obtained by linear calibration methods and data mining techniques. The study was carried out in the Šibenik-Knin County (Croatia) following a summer wildfire that affected an area of 6 ha. A total of 120 topsoil (0 to 3 cm depth) (10 replicates x 3 treatments x 4 time periods) samples from were collected in the interval of 5 days, 3 months, 6 months and 1 year after the wildfire. Samples were collected in plots affected by medium (MS), high severity (HS) and from a non-burned area (control - C). The following soil properties were determined using standard laboratory methods: soil pH, electrical conductivity (EC), carbonates ($CaCO_3$), plant available phosphorus (P_2O_5) and potassium (K_2O), organic carbon (OC), exchangeable calcium (Ca), magnesium (Mg), potassium (K), sodium (Na) and cation exchange capacity (CEC). Soil spectral measurements were obtained using a portable spectroradiometer. Partial least square regression (PLSR) and artificial neural network (ANN) were used to build prediction models of selected soil properties based on original soil reflectance data and first derivative of reflectance. PLSR model was calibrated using cross validation method. In ANN regression analysis, spectra were randomly divided into training and testing sets with proportions of 50% and 50%, respectively. The results showed that spectral reflectance differed ($p<0.05$) according to the fire severity and sampling time. Tukey's *post-hoc* test showed average reflectance of C samples were significantly different from HS and MS, but there was no difference between HS and MS in term of fire severity in all measured time intervals ($p<0.05$). Average reflectance was significantly lower in MS and HS treatments compared to C during the investigated period, indicating significant changes in soil properties persist one year after the wildfire ($p<0.05$). PLSR proved to be the better model for K_2O, $CaCO_3$, Ca and CEC prediction, while OC, P_2O_5, exchangeable Mg and K were predicted better using ANN model. Exchangeable Ca and CEC showed the highest R^2 in PLSR model, with R^2 =0.80, RMSE =4.67 $cmol^+$ kg^{-1} and R^2=0.82, RMSE =4.52 $cmol^+$ kg^{-1}, respectively. OC and P_2O_5 showed the highest R^2 in ANN model, with R^2=0.74, RMSE =4.44 % and R^2=0.74, RMSE =6.35 mg kg^{-1}, respectively. Soil pH, EC and exchangeable Na showed poor predictability in both models. Overall, both PLSR and ANN models showed satisfactory results for prediction of most of the studied soil properties and represent a good insight in spatio-temporal post-fire soil changes.

Acknowledgements

2b.3

Advanced monitoring of agroecosystem at risk of salinization as an adaptation measure to climate change

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Adaptation measures to climate change demand developing an advanced system for monitoring, predicting and reporting on the state on various ecosystems. This especially refers to river valleys, estuaries and deltas that are predominantly used for agriculture and at the same time are at high risk of various degradations due to climate change. In order to control risks, it is important to obtain spatially and temporally articulated data on soil quality. Although the problem of seawater intrusion and salinization of surface and groundwater occurs in all of the Croatian coastal areas, hence increasing the risk of soil degradation, these processes are most evident in the area of Neretva river delta which is considered one of the most vulnerable areas to climate change in Croatia. To assess soil salinity risk in this area, seasonal soil monitoring was set (from 2009-now) with sampling campaigns at the end of the dry/wet season. In 2020, the soil monitoring network was upgraded with frequency domain sensors (FDR) to continuously record changes in soil. The aim of this research was to asses soil salinity dynamics taking into account different monitoring approaches and different temporal resolution of data collecting. Two soil monitoring stations (SMS) have been set up at two different locations with a pronounced risk of salinization in Neretva river delta. Two SMS differ regarding depth of gleyic horizon, soil texture, organic matter content, salinity level and land use: SMS1 vegetable production, SMS2 citrus orchard. At each monitoring station extensive characteristisation of soil physical and chemical characteristics was conducted. Frequency domain sensors measuring bulk electrical conductivity (ECb) were installed at 4 different depths (0-25 cm; 25-50 cm; 50-75 cm; 75-100 cm) with 10 minutes measuring interval. Within the research area an automated weather station was installed (Pinova Meteo weatherstation) to record precipitation and other relevant meteo data. According to the long term seasonal soil monitoring in the wet season the soil was non saline at SMS1 with average value of 1,06 dS/m and slightly saline at SMS2 with average of 3,17 dS/m. Maximum values recorded with this type of monitoring were 4,79 dS/m at SMS1 and 4,95 dS/m at SMS2 respectively. FDR salinity monitoring was set at the beginning of November 2020 and in this paper data for the first 70 days of monitoring were analysed. Within this time frame at SMS1 (1 m depth) average ECb was 2,86 dS/m with an absolute maximum value of 6,38 dS/m (50-75 cm). Average ECb at SMS2 (1 m depth) was 4,07 dS/m with absolute maximum of 6,21 dS/m (75-100 cm). Higher coefficient of variation of ECb was recorded at SMS1 in all horizons in regard to SMS2 where ECb variation was very low, raging from 3,7 % (75-100 cm) to 14,06 % (0-25). Highest coefficients of variability at SMS1 were recorded in horizon 75-100 cm (44,79 %) and 0-25 cm horizon (41,32 %) indicating high soil salinity variation. However SMS2 which had higher ECb in each horizon displayed temporal stability with average coefficient of variation of ECb up to 1 m of 10 %. At SMS1 average coefficient of variation was over 33 % showing temporal instability of ECb. It is important to emphasize that this is an initial set of data and firm conclusions about the dynamics of salinization cannot yet be made but they suggest the importance of developing site specific soil salinity mitigation actions.

2b.4

The effect of MiniKwi (Actinidia arguta) supplementation on physical and chemical properties and productions results in chicken broiler breast muscle

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Presently, natural antioxidant supplements that can improve quality of food and extend it durability are being searched. Plants, vegetable and fruits contain antioxidant that have antibacterial and anti-inflammatory properties. They are mainly represented by polyphenols and phytoestrogens. The most popular antioxidants are zeaxanthin, lutein and beta carotene. Among fruits, antioxidant activity is characterized by berries, of which the MiniKiwi has recently achieved popularity. MiniKiwi (*Actinidia arguta*) contains a large amount of antioxidant compounds, e.g. vitamin C, polyphenols and carotenoids (Michalczuk et al., 2018). The aim of the study was to examine the effect of the addition of freeze-dried MiniKiwi fruit on the physical and chemical properties and quality of chicken breast muscles. The aim of the study was to examine the effect of the

addition of freeze-dried MiniKiwi fruit on the chemical composition and quality of chicken breast muscles. The research material consisted of Ross 308 chickens fed with starter feed, grower feed and finisher feed with the addition of freeze-dried MiniKiwi. The experimental scheme was as follows: control group, experimental group I (receiving 1% of fresh freeze-dried MiniKiwi fruit supplement (*Actinidia arguta*) to feed applied twenty days), experimental group II (receiving 2% of freeze-dried MiniKiwi fruit supplement (*Actinidia arguta*) applied for twenty days). After cooling, the poultry carcasses were weighed and their weight determined with an accuracy of ± 1.0g and then the slaughter capacity of the broilers was calculated by determining the percentage share of the carcass weight in the total body weight of the bird before slaughter. The dissection was carried out as described by Murawska et al. (2011). The obtained results were used to calculate the percent share of these elements in relation to the cooled weight of the carcass before its division. Qualitative analysis of pectoral muscles were conducted - estimation of chemical composition using near infrared (NIR) and physicochemical properties: pH (PN-ISO 2917:2001), measurement of cutting force on fresh muscle using the Warner-Bratzler attachment in ZWICK strength testing device. Obtained results were analyzed using statistical program the SPSS 24.0 PL for Windows. The variability of the examined features with normal distribution was checked by the Kolmogorov-Smirnov test. Muscles from chickens experimental group I had the highest cutting force, muscles from chicken experimental group II had lower cutting force then muscles chicken from control group. The impact of experimental diet on free leak from breast muscles in chicken broilers was revealed (P ≤ 0.01). Obtained results revealed the effect of diet on psychophysical parameters and quality of breast muscles in chicken broilers. The supplementation of MiniKiwi fruit in chickens diet had positive impact on cutting force, pH value and free leak.

Oral session 3a: Modern agriculture (new challenges in plant and animal sciences, biotechnologies)

3a.1
Impact of Soaking Aqueous Ammonia pre-treatment of lignocellulosic biomass intended for bioethanol procurement

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Currently, in times of growing environmental awareness and the spread of government policies restricting usage of traditional fuels, biofuels obtained from non-edible feedstock get the most attention. One example of such up-to-date energy source is bioethanol made from lignocellulosic industrial residues or fast-growing wood species.Those materials have high content of cellulose and hemicelluloses, which can be easily hydrolyzed into fermentable simple sugars. However, the matrix of cellulose, hemicelluloses and lignin, of which wood and corn stover are formed, is resistant to enzymatic degradation. Therefore to maximize the effectiveness of industrial bioethanol production process certain pre-treatment is required which would increase enzymatic accessibility. This research attempts to study the influence of Soaking Aqueous Ammonia pre-treatment of lignocellulosic biomass obtained from corn stover and 7-years old fast-growing poplar wood (Populus trichocarpa) considering further bioethanol production. The backbone of the research is a comparison between properties of the initial biomass and material after pre-treatment. Both before and after those procedures feedstock is a subject to a detailed analysis which consists of: chemical composition (amount of extractives, minerals, lignin, cellulose, hemicellulose), degree of polymerization, changes in porous structure. Finally enzymatic hydrolysis is carried out to characterize the amount of accessible simple sugars obtained from treated material that could be used during consecutive alcohol fermentation. Research is part of project of National Center for Research and Development (NCBiR) BIOSTRATEG2/298241/10/NCBR/2016 ,,Intelligent systems for breeding and cultivation of wheat, maize and poplar for optimized biomass production, biofuels and modified wood".

3a.2
Recent insights on biotechnological processes of bee bread fermentation

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Introduction: Bee bread or ambrosia is a unique product for bees and humans, form from bee collected pollen, nectar, and secretions of bee's salivary glands after lactic acid fermentation in the honeycombs. Bee bread as per nutritional and chemical composition is an excellent source of essential amino acids, ω-3 fatty acids, B-complex vitamins, minerals, and polyphenols; however, the huge variation in composition due to the different botanical and geographical origin is still a challenge to promote the bee bread on the bee products market. Under anaerobic conditions, the pollen brought into the hive suffer a lactic acid fermentation process caused by *Pseudomonas spp*, *Lactobacillus spp,* and *Saccharomyces spp* yeasts. As a result of biochemical transformations and microbial metabolism, bee pollen is converted to bee bread. The fermentation process, as a consequence of enzymatic transformations, increases the content in new compounds like catalytic enzymes which alongside microorganisms involved contributes to the protective and nutritious effects of bee bread.
Scope and approach: We attempt to highlight the existing biotechnological processes, including screening of suitable microorganisms, as well as the specific parameters, for simulating the natural bee pollen fermentation to obtain bee bread. Moreover, the chemical components are discussed to emphasized their nutritional value.
Key findings and conclusion: Bee collected pollen according to the existed studies could represent a suitable substrate for solid-state fermentation for emulating the natural process that occurs in the hive and generating a value product for human nutrition. Many studies have shown a possible protocol for fermenting bee pollen, simulating the natural fermentation of bee bread produced in the hive, future research should focus on establishing a precise protocol for the solid fermentation of bee pollen. In addition, attention should also be concentrate on the characterization of aromatic compounds, the impact of flavorings, and the need of consumers to offer bee-fermented products the opportunity to make their presence felt on the bee products market.

3a.3
Comparizon of the effects of biostymulator Goteo & several growth regulators on rooting and *ex vitro* acclimation of microcuttings in rhododendron (*Rhododendron*L. 'Kazimierz Odnowiciel')

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Micropropagation allows to quickly obtain high numbers of good quality and healthy plants. However, during the last stage of the procedure, i.e. acclimation a high mortality rate may occur. This is due to transfer of plantlets from sterile laboratory conditions to the exterior environment where the conditions are stressful for young non adapted plants. Stress during acclimation may be minimized by using growth regulators or biostimulators which improve a general plant condition. The aim of this work was to develop a protocol of rooting and acclimation *ex vitro* of microcuttings of rhododendron 'Kazimierz Odnowiciel'. This is precious variety of Royal Rhododendrons group of high frost resistance (up to -30 °C), very abundant flowering, dense plant habit and oval, shiny leaves. The shurb is highly resistant to diseases as well. The following preparations/substances were used: water solution of biostimulator Goteo (0.4%) and growth regulators: abscisic acid (ABA 0.001%), indolil-3-butyric acid (IBA 0.2%), brassinolide (BR 0.001%) and epibrassinolide (BL 0.001%). The experimental material came from the *in vitro* cultured plants. Two-nodal microcuttings were rooted and acclimated in plastic boxes filled with the mixture of peat and perlite (2:1, v/v), pH 5.0, placed in a phytotrone at 25°C under 16 h day (50 µmol·m^{-2}·s^{-1}). There were 6 treatments, each in triplicate, each containing 30 microcuttings. After 4 weeks the effect of the treatments on acclimation, shoot length increase and rooting parameters (percentage of rooted cutting, root number and length) were evaluated. Both, the biostimulator and growth regulators affected plant growth during the acclimation. The highest survival rate was obtained with Goteo while the auxin IBA stimulated rooting.

3a.4
Probiotics microencapsulation in casein-free carrier by spray-drying

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Introduction. Probiotics are living microorganisms that are capable of conferring health benefits when ingested in adequate amount, the most usual probiotic bacteria genera being *Lactobacillus* and *Bifidobacterium*. The development of new probiotic products imposes the challenge of incorporating viable probiotic cells into the food matrix without causing undesired viability loss during the process. (Nan Fu, 2018)

Aim. The focus of this work was to use a casein-free edible matrix for the microencapsulation of different probiotic strains, that can keep high cell viability during long periods of storage.

Materials and Methods. In this experiment 6 different strains of probiotics (*L.plantarum*, *L.casei, L.paracasei, L.rhamnosus, L.acidophilus, B.bifidum*) where grown in MRS broth in controlled conditions of pH= 6.4 at 37^0 C and 150 rpm for 18 h, using a 1.9 litres bioreactor. The formed biomass was centrifuged at 7000-10000 rpm for 5-10 min, washed 3 times and concentrated in sterile serum solution. The obtained slurry was transferred into the carrier, which consisted of a sterile solution of 24 % maltodextrin and 4 % glucose. Then the mix was spray-dried at 126^0 C, 6 bars of air pressure and a flow rate of 22 mL min^{-1}, into a fine powder, followed by storage at room temperature. The cell viability of the probiotic powders was determined monthly, using the pour-in plate method with MRS agar, and the dried weight using the oven drying method, during the 6 months of storage.

Results. The use of the casein-free carrier as the microencapsulation matrix for probiotics presented good cell protection for both the spray-drying process and long periods of storage. During the 6 months of storage the cell viability of the probiotic powder decreased from $4.5 \pm 0.5 *10^{12}$ to $1.2 \pm 0.5 *10^9$ cfu g^{-1} and the dried weight remained constant at 96.7±0.7 %.

Conclusion. This work proved that the casein-free edible matrix used was efficient for spray-drying microencapsulation of different strains of probiotics and for preserving the bacteria at high cell viability for long periods of time.

References 1. Nan Fu, Song Huang, Jie Xiao, Xiao Dong Cheng (2018). Chapter Six - Producing powders containing active dry probiotics with the aid of spray drying. Advances in Food and Nutrition Research, Volume 8, Pages 211-262

3a.5
Solid-state yeast fermentation of wheat and oat bran

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Introduction: In the cereal-processing industry, the wastage rate is at 30% (286 million tons), mainly represented by bran tissues, whereas wheat and oat are among the most consumed staple foods. Solid-state fermentation (SSF) is among the most promising and efficient route for cereal bran re-valorization resulting in a bioaccesible source of natural antioxidants. **Aims:** This study aimed to build and evaluate an economically-attractive bioprocess using *Saccharomyces cerevisiae* (baker's yeast) as a GRAS and cheap microorganism under SSF conditions, with the final goal of improving the phenolic content and composition, and antioxidant capacity of industrially derived wheat bran (WB) and oat bran (OB) by-products, by considering the effect of fermentation time.

Materials and Methods: Total phenolic content (TPC), phenolics composition (HPLC-MS/MS), and *in vitro* antioxidant activity (DPPH) of the ultrasound-assisted methanolic extracts were determined in order to

optimise the solid-state yeast fermentation (SSYF) time and provide a green technology with high efficiency and low costs.

Results: The results shown significant differences (p<0.05) between days of fermentation, whereas for WB the maximum increase of TPC (+112%) and phenolics composition (ferulic acid +56.6%, vanillic acid +259.3%, di-hydroxybenzoic acids +161.2%, apigenin-glucoside +15.3%) were registered on day 3, and for OB the maximum increase of TPC (+83%) and phenolic composition (avenanthramide 2f +48.5%, ferulic acid +21.2%) were registered on day 4. Fermented WB and OB displayed the highest DPPH percentage inhibition (51% and 64%) on the same days, being significantly correlated to TPC. **Conclusion:** SSF can be applied for enriching the phenolic acid contents and antioxidant activity, thereby improving their bioaccesibility from WB and OB. *Saccharomyces cerevisiae* is an economically attractive solution for industrial reproducibility potential of scientific studies, with a major positive impact on agro-industrial by-products management via their recirculation. Cost and availability are the main factors to be considered in the choice of a residue as a substrate or support in SSF.

Oral session 3b: Modern agriculture (new challenges in plant and animal sciences, biotechnologies)

3b.1
Polish Red cattle - the first Polish breed of beef cattle

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In Poland, we have four breeds of cattle in the program for the Conservation of Genetic Recourses of Farm Animal with dairy or bi-directional use, i.e. dairy and beef. The oldest of them is the Polish Red cattle, commonly kept for the of milk production. However, individuals of this breed are not distinguished by the high milk yield as the Holstein-Friesian cows. Currently, however, it enjoys more and more popularity among beef cattle breeders. Polish Red cattle in Poland (as of 2020, data from the Institute of Animal Production Balice-Kraków) is 3421 animals. This breed is characterized by high resistance and excellent adaptation to the foothills and mountains' harsh environmental conditions. Still, it also enjoys considerable interest breeders from other regions of the country. Besides, animals of this breed have many biological properties of great economic importance, such as good fertility, ease of calving score cows, long vitality of calves and a higher percentage of their survival than in other breeds. Polish Red cattle are characterized by excellent farm fodder use (especially dry roughage in winter, and pasture grass in summer) and indiscriminate selection. Moreover, it is resistant to diseases (e.g. mastitis, tuberculosis, brucellosis). Polish Red cattle provide not only milk but also excellent quality meat. Due to their native characteristics, cattle of this breed have become a good alternative for breeders keeping other beef cattle breeds. It is undeniable that the meat of this breed is characterized by tenderness, appropriate marbling and juiciness. Some of the features mentioned above are also characteristic of unique species of beef cattle. Therefore they can be used to develop a new direction of use, which is the beef direction. The lack of previous research on developing a beef performance model for cattle of this breed is an incentive to start cooperation with the Polish Association of Breeders and Producers of Beef Cattle and with the Institute of Animal Science of the Warsaw University of Life Sciences. It is to implement a joint project financed by the Ministry of Science and Higher Education as part of the implementation doctorate program. Thanks to its implementation, 72 new herds were created in Poland last year, keeping cattle of this breed in the beef type, and the number of cows increased by 1,027 heads. Also, numerous farms in Poland began to replace the existing breeds of cattle with the Polish Red breed, increasing its number at the same time. The project's overriding aim is to develop a beef performance model and compare it with Polish and French limousine cattle. The research has covered 942 limousine bulls - 492 of Polish origin and 450 of French origin, and 115 heads of Polish Red cattle. The following parameters were determined: body weight at birth (kg), body weight at 210 days of age (kg), bodyweight of bulls at 420 days of age (kg), daily gain (g), bodyweight standardized for 210 and 420 days of life (kg). Additionally, an assessment of the habit was performed for cattle with bodyweight measurement. The animal's conformation was determined with 19 linear features characterizing its muscles, skeleton, functional components, and additional features. In total, 2,033 measurements of habit assessment for Polish Red cattle and 27,318 sizes for Limousine cattle were performed. The existing database consists of 128,592 records, which constitute the described features and pedigree of the father-Sir bulls.

3b.2
Equine neonatal maladjustment syndrome

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Professional veterinary care of critically ill foals can dictate the future of the newborn. Therefore, early recognition and therapy are essential. Postpartum emergenciens are associated with dystocia, difficult birth, placentitis, premature placental separation, twin pregnancy and other conditions. Common diseases among neonatal foals are prematurity, enterocolitis, spepsis and neonatal maladjustment syndrome (NMS). Neonatal maladjustment syndrome (NMS), known also as hypoxic ischemic encephalopathy (HIE) or dummy foal syndrome, is a condition affecting neonatal foals. Clinical signs include neurobehavioral changes such as absent suckle reflex, seizures and poor foal attachment to the mare. Any changes in foal

behavior in the postpartum period might affect survival chances of a newborn. Foals that can't posses the ability to stand up in less than 60 minutes have a significant increase in morbidity and mortality (McCue et al., 2011). The aim of the study is to review the newest publications discussing the possible etiology and treatment of the condition. Historically, NMS was associated with dystocia causing hypoxia and ischemia. Hypoxic encephalopathy normally causes long-term neurological deficits, but persistent neurological changes are rare in foals with NMS. Critically ill equine neonates have elevated concentrations of steroids, neuroactive steroids and steroid precursors (Dembek et al., 2017). Elevated progesterone concentration, not cortisol, is the strongest predictor of non-survival (Dembek et al., 2017). Infusion of allopregnanolone, a progesterone metabolite, to a healthy newborn foal changed its behavior. The foal had symptoms of NMS, but no long-term effects were observed (Madigan et al., 2011). In healthy neonates pregnanolone and progesterone concentrations decreased quickly by 24 hours of age (Aleman et al. 2019). The transition from the *in utero* to the extrauterine state involves changes in steroid concentration. Hypothalamic-pituitary-adrenal axis plays a major role in this transition. It is hypothesized that the proper transition needs physical compression of the throat during labor. Foals with NMS that were squeezed for 20 min had faster recovery than the not-squeezed foals. Faster recovery improves animal welfare and reduces costs of hospitalization. No side effects of „Madigan Foal Squeeze" were reported (Aleman et al., 2017). The role of pressure and other stimuli in the neurobehavioral changes in neonates is still not fully understand. Therefore, more studies to enhance the understanding of the pathophysiology of NMS are needed.

3b.3
Use of phytogenic feed additives to alleviate the negative effects of mycotoxins on poultry health

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The poultry industry is a large, rapidly growing sector of global livestock production. Despite the huge progress made in this area, there are still some issues facing the industry. One of them is the contamination of poultry feed with mycotoxins, which is a common problem worldwide. In addition, successful strategy for testing and controlling mycotoxin levels in feed is still lacking. The negative impact of mycotoxins on the health of poultry is mainly related to reduced immunity, disruption of the intestinal barrier and its increased permeability. What is more, in most cases the feed is contaminated with more than one mycotoxin at a time. This can result in worse productivity, increased disease incidence and thus economic losses. While the search for optimal solutions continues, high hopes are for the inclusion of alternative feed additives in poultry diet. Complete elimination of mycotoxins from the feed appears to be impossible so far and mitigation strategies are a promising alternative. Phytogenics seem to have a great potential, thanks to the complex composition of plant-derived products and their antioxidant, anti-inflammatory and immunomodulative properties. They also have the ability to improve the integrity of intestinal barrier. This results in a growing interest in phytogenic feed additives among veterinarians, nutritionists and breeders. What is more, plant-based products gained social acceptance, and are considered as "safe" feed additives. However, there is still a need for more evidence-based data to justify their use in livestock production. For example, promising results have been obtained with preparations derived from plants such as turmeric, rosemary, oregano, thyme or *Cinnamonum*. This presentation provides an overview of the possible use of selected phytogenics to partially or completely alleviate the negative effects of mycotoxins on animal health.

3b.4
Artificial Intelligence in agriculture - Why farmers will soon become AI experts

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The significant developments of artificial intelligence (AI) in the last decade indicate a clear trajectory: AI will impact every branch, industry, and economy, including agriculture. Leveraged by AI, the value creation foreseen by experts, futurists, and consultancies will be extensive over the next two decades. The

agricultural sector will have its part of AI-induced economic growth. Yet for most farmers, learnings and preparations have barely gone passed the conceptualization phase.

What is AI?

In the first section, Artificial Intelligence (AI) will be explained in the context of agriculture. What defines AI? How can farmers acquire basic knowledge about AI? How can AI support and foster the agricultural sector? What farmers should do to prepare for the implementation of AI: collect valuable data, learn about the potential of AI, understand and tinker with recent applications, understand implications and trajectories of AI.

AI for augmenting tasks of farmers - The second part of the presentation focuses on the use of AI as an augmentation along the agricultural supply chain. Activities every farmer must accomplish can be simplified/streamlined and/or optimized by AI. Processes like season and crop planning, weather prediction and implications, efficient use of fertilizers and pesticides; these are all exemplary fields that can benefit from integration of modern information and computing technology. Furthermore, the efficiency of activities not strictly concerning the field of agriculture can be enhanced by AI: sustainable energy management or efficient administration and documentation processes. Besides the current level of technology, newest insights of leveraging sciences and AI market research tools will be examined.

AI for taking over tasks of farmers - How far developed are autonomous systems for field work? Can farmers already leave quality control, sorting operations, or health monitoring solely in the "hands" of AI? What exactly is the difference between automation with and without AI? What internal safety measures are necessary to balance risk and reward?

AI for rethinking businesses - Developed outside agriculture, business process design and business modelling with AI are awaiting to be applied in agriculture. Besides the current level of technology, newest insights of leveraging sciences and AI market research tools will be examined. Potential new business partners of agriculturalists may not be the old ones. The five Big Tech companies Google, Facebook, Amazon, IBM, and Microsoft, dominant in the information technology industry, are offering AI as a service (AIaaS) for enterprises of all sizes.

Digitization and AI in agriculture in Hungary - Lastly, a best practice view on the Hungarian developments in agriculture is shared. Ahead of many other nations, Hungary deployed 4G and already 5G to many rural areas. The technological advantage allows for agricultural AI application at the leading edge.

3b.5
Consumer preferences of poultry meat quality

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Meat is an important component of the human diet and a source of valuable nutrients. It is also a source of exogenous amino acids, minerals (like zinc, iron, phosphorus and copper) or the B complex vitamins (mainly thiamin, vitamin B6, vitamin B12). Poultry meat is also characterized by a moderate energy content and the content of higly digestible protein. Poland is the largest poultry producer in the European Union. Both the production and consumption of this kind of meat in our country is constantly increasing. Consumer awareness is also growing regarding products available on the market and the impact on health of proper nutrition. The purpose of this work was to develop a survey with a range of questions about the consumer preferences in terms of meat consumption, with particular emphasis on poultry meat. The survey was shared on the Internet for a month in the Google forms tool. It was anonymous but contained two questions about the metric. The respondents indicated gender and age range from 10 to 65+ years of age. In total 263 respondents took part in the research. The participants came from the Mazowieckie, Podlaskie and Pomorskie voivodeship in Poland. They were asked, among of all, about how often they buy or eat poultry meat, which species of poultry meat they prefer, what they pay attention to when they choose meat products or why they choose poultry meat. They survey also contained questions about preferences of breast meat in KFC® and McDonald®. Based on the conducted research, it was shown that consumers when buying raw meat pay attention to the overall appearance, colour and any changes on its surface. However, when choosing products from chains of restaurant 46.4% of people indicated that they prefer Strips from KFC®, and McNuggets from McDonald® choose only half of them or 23.2% of respondents.

Oral session 4b: Rural development (includinglandscape planning) and rural economies

4b.1
Smart food labels based on agro-industrial by-products

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Introduction: These days, technological innovation is in incessant development in all areas, such as medicine, pharmacology, food technologies, as well as food packaging. Significant efforts are also being made to innovate food packaging, in particular, to find a balance between consumer preferences, environmental protection, and the requirements associated with food quality management and control.
Scope and approach: The present study has concretely defined the concepts of smart, active, and intelligent packaging, classifying the commercially available models found in the marketplace. Also, several bioactive compounds had been identified and characterized, compounds that can be recovered from the agro-industrial by-products, and can be integrated into smart food packaging components (sensors, indicators, radio frequency identification), supporting the "zero waste" actions. In addition to the main agro-industrial by-products, other concrete examples of resources are presented, such as residues from the fish industry (heads, gills), or the vegetable products industry (grape pomace, banana peels, mango seeds).
Conclusions: The sustainable and industrial perspective of smart packaging in the food industry is unquestionable and most importantly, this work highlights the opportunity of including the by-products resulting compounds to intelligent packaging. The next generation of food packaging advances and food packaging materials should be environmentally friendly, and more importantly, they should be recyclable, easy to use, and communicative with the consumers, to avoid the specific problems related to food waste, food quality managing, or foodborne diseases.

4b.2
Once upon a time there was a field - the impact of local spatial planning approaches on agriculture in peri-urban areas

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Urbanisation leads to a steady decline in farmland in peri-urban areas. Due to the rapid population growth higher priority is being given to non-agricultural land uses at the urban fringe. This endangers both the survival of local farms and the quality of life, as agriculture can no longer or only to a limited extent perform its social functions, such as the supply of regional food or the maintenance of local recreation areas. Traditionally, agricultural policy is regarded as responsible for securing the well-being of farms. However, recent studies have shown that in peri-urban areas this function is increasingly being taken over by land-use policy, a discipline that has so far been little considered in connection with agriculture. This study therefore aims to take a closer look at the current relation of agriculture and peri-urban land-use policy, through focussing on local spatial planning approaches: What impact does local spatial planning have on agriculture at the outskirts of Vienna? A systematic case study selection brought up Aderklaa, a municipality situated at the Viennese city border. In 2017 the agricultural quota of Aderklaa had been 31,7%, it maintains a stable population size and converts agricultural land only marginally (~ 3% in the last decade). Aderklaa's case is contrasted with another municipality at the outskirts of Vienna, Leopoldsdorf bei Wien, with an agricultural quota of 0,29 %, a population growth of 14% and a conversion of approximately 15% of its share of agricultural land in the past decade. 23 problem-centred interviews with local spatial planning actors and resident farmers provided insight into the local spatial planning institutions. A cross-case comparison based on the Institutional Analysis and Development (IAD) framework shows that local spatial planning decisions indeed impact farms on the urban fringe in many ways. Furthermore, it was found out that local spatial

planning policies are capable of both impeding as well as supporting farms, depending on the goals and activities of the respective local spatial planning institutions.

4b.3
Pannage and preferred sales canal for Turopolje pig

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Turopolje pig belongs to the chategory of the most endangered pig breeds. It is a domestic Croatian, fatty-type, medium sized and primitive pig breed. For centuries it was a significant breed for the local population, but due to the arrival of hybrid breeds, breeding has been reduced. Today, breed counts 21 boars and 177 sows, and the population hasn't grown significantly over the past 10 years (HAPIH, 2020). The breed is keping entirely on family farms, 21 of them and that's it mainly in the area of Zagreb county, Sisak-Moslavina county and Varaždin county. Turopolje pig is originally a pig adapted to the external environment in the biocenosis of floodplain forests of pedunculate oak and ash, beech and wetland meadows and continental climate and low-input technology with the use of natural resources of the environment in which production takes place. Therefore, the other reason for the decrease in its population, along with the breeding of more profitable breeds of pigs is the forest grazing ban by the state (pannage), which does not allow it for feetting pig. There was a need to examine the opinion of citizens with an online survey about the ban. The research conducted aimed to determine what the respondents think about unconditional keeping of pig in forests, does any restrictions should be abolished or not. Although there are no easily available products of Turopolje pig on the market it is important entrench the prefered canal for buying products from Turopolje pig and reasons why respondents prefer some particular sales channel. Most respondents believe that bans should be left even they know that forests are natural habitat of that domestic pigs and potential consumers are the most interested to buy Turopolje pig products directly from producers in traditional markets. A stronger association of breeders and a better strategy of the state must keep the existing breeders, and gain new ones to keep Turopolje pigs, from which specific products can be obtained and than be segmented on the pork market.

4b.4
Energy transition in mountainous areas through the example of micro-region in Borsod county in Hungary

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Energy production and consumption are responsible for almost 80% of greenhouse gas emissions. To effectively reduce emissions related to energy production and consumption, thereby slowing down climate change, research of energy transition can contribute. Geographical and geological features are decisive in terms of available energy. There are significant differences between mountainous and lowland areas. In this research, we examine the energy sources of mountainous areas through the example of Hungary. The project area contains 9 small settlements (Bükkmogyorósd, Csernely, Csokvaomány, Dédestapolcsány, Lénárddarc, Nagyvisnyó, Nekézseny, Sára, Szilvásvára) and situated in Borsod-Abaúj-Zemplén county, south from the second largest town (Ózd) in the region.Our research goal is to show the typical energy sources are available in mountainous regions and how these can be efficiently used. Our research questions focus on the characteristics of the area and energy efficiency through landscape architecture tools. Which energy sources are determined by geographical location? What are the geological conditions of the area and what role do they play in terms of energy sources? How can the area's energy resources be used most efficiently? We present the geographical and geological characteristics of the sample area in north-east Hungary. We then examine the spatial and temporal changes in the use of energy sources in the area. We analyse which energy sources can reduce greenhouse gas emissions, what other environmental impacts should be considered when using each energy source. Finally, we present landscaping tools for energy

efficiency. As the project area consists of 9 settlement the research can identify the general characteristic and unique phenomenon.Geographic and geological conditions influence significantly mountainous regions. The study of the surface water system is of paramount importance for the use of hydropower. Transition in the context of water and energy have changed the landscape both in space and time, and the spread of geological conditions and the use of fossil fuels also played an important role. The proportion of agricultural and forest areas determines the biomass potential and tilts in favour of forests due to topographical features. However, biomass, as a renewable energy resource, has high negative environmental impacts. Mountain areas have significant renewable energy potential, which significantly determined by geographic and geological conditions. The phenomenon of energy transition defines the landscape of the project area, and this analysis drives to influence the effectiveness of the energy system by landscape architecture tools.

Oral session 5a: Sustainable food systems and quality

5a.1
Physico-chemical characterization of soy-flour enriched wheat dough fermented with polyol producing lactic acid bacteria and bakery yeast

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The primary cause of dental caries, obesity, type 2 diabetes, cancer, and cardiovascular diseases is due to the consumption of foods with high sugar content. To decrease the consumption of added and free sugars, taking into account the instructions by the World Health Organization (WHO), several countries are adopting regulations for lowering the sugar intake of the population, especially children. Nowadays, with the substantial change of dietary habits, increased attention is given to the reduction of sugars in bakery products and the addition of flours with high bioactive components. The incorporation of alternative natural sweeteners (i.e. polyols), like mannitol or erythritol in bakery products, presents various favorable effects. The digestion of these non-nutritive sweeteners is not entirely attainable by humans, and the majority is excreted unaltered in urine, providing a low source of calories and low glycemic index. Bakery products enhanced with soy flour also present a good substitute with several health benefits given by isoflavones. The study aimed to use polyol-producing lactic acid bacteria (LAB), with the outcome of sugar reduction in bakery products, and to enhance dough with isoflavonoids derived from soy-flour.The microorganisms used were the LAB *Lactobacillus florum* and *Leuconostoc oenos*, in single or co-cultures with the bakery yeast *Saccharomyces cerevisiae*. Each experiment was additionally prepared in 100% of wheat dough, 95% wheat flour with 5% soy-flour, and 90% wheat flour with 10% soy flour. The viscoelastic behavior of wheat-soy doughs was characterized.Fermentation of the used microorganisms showed multiple positive effects, which, combined with increased soy-flour content, improved the dough's rheological and physicochemical qualities. The addition of soy-flour improved organic acid content. Lactic acid production increased to a quantity of approx. 4 g/L, butyric and acetic acid decreased continuously to values close to zero. The growth dynamic of lactic acid bacteria was higher in co-cultures and soy-flour enriched dough. This study contributes to the development of functional foods with the reduction of added-sugar in bakery products. Furthermore, the addition of soy-flour is a practical approach for the production of functional white flour-based bakery products without considerable modification of its physical properties.

5a.2
Study of phytotoxicity of Gadolinium on Stevia rebaudiana grown in vitro

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Lately, there is growing interest towards the potential toxicity effects that different nanoparticles or chemicals used more and more extensively in everyday life applications could exert on the environment and on edible plants. Gadolinium (Gd)-based contrast agents are extensively used for diagnostic purposes in magnetic resonance imaging (MRI). Since their approval in 1980's, they have become indispensable for diagnostic imaging, and are currently being used in 33-50% of the MRI investigations. Apart from their tremendous contribution in disease diagnostic, there are several issues related to their use. After administration, the Gd-based contrast agents are excreted unmetabolized and a significant amount is present in hospital effluents and, consequently, in wastewaters. For example, Gd presence in tap water and tap water-based beverages such as Coca-Cola from fast-food franchises in big cities in Germany has been documented. Our research is focused on potential risks associated with plants exposure to Gd. Thus, we have assessed the accumulation of Gd on *Stevia rebaudiana* grown *in vitro*, and its impact on plant growth, morphology and on a series of plant metabolites (chlorophylls, carotenoids, ascorbic and dehydroascorbic acids). The plants were exposed to gadobutrol in concentrations up to 1mM. Gd accumulation in the plant tissues was studied by inductively coupled plasma-optical emission spectrometry (ICP-OES) and it was found that accumulation increases in a dose dependent manner. Regarding plant growth and morphology, the results showed that the total plant length was unaffected by Gd exposure, while the root length and biomass showed a statistically relevant increase upon Gd exposure. The plant metabolites were quantified using high performance liquid chromatography (HPLC). The concentrations chlorophyll A and B, pheophytin A and B, lutein, zeaxanthin, and beta-carotene showed the same trend upon exposure to increased Gd levels. Their concentrations increased up to 0.1 mM Gd doses, while for the highest exposure level of 1mM, the concentrations of all investigated analytes were significantly decreased compared to controls. Such pronounced effects of Gd on the levels of antioxidant molecules can be related to a stress response of the plant. More in depth information on this issue is still under investigation.

5a.3
The content of bioactive compounds in raspberry fruit and leaves depending on the cultivation method

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Raspberry fruits are a perfect source of polyphenols, including flavonols, anthocyanins. Some experiments have indicated that organic fruits contain more bioactive compounds than conventional fruits. The research presented in this paper was aimed at determining the impact of organic and conventional farm management, harvest time and cultivar on the content of bioactive compounds and selected nutrients in raspberry fruit and leaves. In this study compared the concentration of bioactive compounds in organic vs. conventional raspberries and to determine the effects of cultivar. Three cultivars of raspberry ('Laszka', 'Glen Ample' and 'Glen Fine') were harvested in summer time and one 'Polka' cv. was harvested in autumn time. The organic raspberry fruits contained significantly more polyphenols. The organic samples contained significantly more phenolic acid and flavonoids, including myrycetin, quercetin, luteolin and quercetin-3-*O*-rutinoside. Harvest time was an important factor in raspberry fruit quality. Moreover, the second aim of this experiment was to identify and determine the polyphenolic, chlorophylls and carotenoids in the leaves of selected raspberry cultivars and their *in vitro* activity. Organic leaves were characterized by a significantly higher content of polyphenols; moreover, the organic leaves were characterized by higher antioxidant activity than conventional ones. However, conventional raspberry leaves contained more carotenoids and chlorophylls. In addition, in this experiment was to compare the content of vitamin C, sugars and organic acids in organic vs. conventional raspberries and to determine the effects of cultivar on the contents of these compounds.

Fruits from four raspberry cultivars ('Laszka', 'Glen Ample', 'Glen Fine' and 'Tulameen') were collected in the summer and fruits of the 'Polka' cv. were collected in the autumn. The conventional raspberries grown in the first year of the experiment contained a significantly more vitamin C and dehydroascorbic acid content compared to organic raspberries. We observed an effect of the cultivar on the organic acids content in raspberry fruit. 'Laszka' cv. and 'Glen Fine' cv. fruits contained significantly more total organic acids and citric acid compared to the other experimental cultivars. However, the in the second year of the experiment 'Tulameen' cv. was characterized by the highest levels of total sugars and sucrose content. Due to the high content of biologically active compounds and high health-promoting potential, raspberry fruit and leaves should be part of a healthy diet.

5a.4
Assessment of the bioactive compounds found in tomato processing by-products influenced by industrial heat treatments

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In the field of food industry, approximately 42 million tons of tomatoes are processed yearly and large amounts of tomato processing by-products are generated, namely tomato peels, tomato seeds and the mixture of these two together, called tomato pomace. These by-products sum up 5-30% of the main product and contain many bioactive components like carotenoids, polyphenols, polyunsaturated fatty acids, pectin, dietary fibers, and others. In the context of the circular economy and bio-based economy, involving principles related to food waste reduction and integration of recovered nutrients to the market, the extraction and integration of bioactive components found in tomato processing by-products as functional food ingredients, natural colorants or edible oils, could be of great interest for stakeholders and not exclusively. The present study aims to highlight the valuable bioactive components found in tomato processing by-products (carotenoids, phenolic compounds and fatty acids) influenced by industrial pre-treatments, particularly cold break (CB) process at 65-75°C and hot break (HB) process at 85-95°C. Besides the physicochemical parameters, such as relative density, iodine value and refractive index, generally used as quality indicators for edible oils, the fatty acid profile of the tomato seed oil was examined by gas chromatography coupled to mass spectrometry (GC-MS), individual carotenoid and phenolic compositions were determined by high-performance liquid chromatography (HPLC) and the viscoelastic properties were evaluated by rheological measurements. The physicochemical properties revealed appropriate characteristics of the tomato seed oil in order to fit the standards of generally accepted edible oils, for both CB and HB derived samples, however, significant qualitative and quantitative differences were detected in their phenolic composition and carotenoids content. Lycopene (37.43 ± 1.01 mg/100 mL) was a major carotenoid in the examined samples, linoleic acid was the main fatty acid (61.73%) detected in the tomato seed oil and syringic acid appeared to be one of two major phenolic acids detected in the samples of CB process. HB process affected the tomato seed oils composition, quantitatively and qualitatively, as caffeic acid-glucoside isomer and caffeic acid were diminished to undetectable quantities and syringic acid showed a two-fold decrease. Our findings extend the boundaries of tomato processing industry by validating that tomato seed oil is a bioactive rich edible oil with additional health benefits, which can be integrated in functional food products and as well, tomato peels can be used as natural colorants in food products.

5a.5
Chemical characterization, extraction optimization and antioxidative potential assessment of prickly pear *Opuntia ficus-indica* from Croatia

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Opuntia (*Opuntia ficus-indica*), or prickly pear, thrives in regions with mild winters, relatively low humidity, and a variety of soils. Native to the Americas, it is now found worldwide in zones of arid and Mediterranean climate. As an invasive species, it presents a promising target in agriculture as it is very robust, needs minimal growing cost, resulting in a high yield of fruits per plant, and has very few threats from pests and diseases. Fruits can be used for human nutrition, while the cladodes have recently been considered for animal fodder. Opuntia can also be used for the production of bioethanol and bioplastics and as an affordable approach to erosion control. Red beet and prickly pear contain the highest amounts of betalains, and are the only approved sources of betalains as colorings for the food industry. Chemical characterization of prickly pear fruit and seeds from the coastal part of Croatia was studied in terms of total betalains, total polyphenols, antioxidant activity, ascorbic acid, total sugar, and reducing sugar content. The second aim of this study was to extract bioactive components from opuntia seeds by conventional solvent extraction and high-power ultrasound-assisted extraction. Extraction efficiency for selected components was compared and a two-factor Box-Behnken response surface methodology was implemented in extraction optimization. Extraction of treated and untreated seed samples was performed in various timeframes with water, 10%, 25%, and 50% ethanol. The largest yield of total phenolics was obtained with samples that were treated for 20 min, using 50% amplitude in 50% ethanol solution. Antioxidant activity increased with ethanol ratio while being highly dependent on the extraction time. Highest antioxidant activity is noticed with 50% ethanol as solvent. The ultrasound-aided extraction method has shown higher antioxidant activity of the samples, as compared to the samples that were subjected to the conventional extraction method.

Oral session 5b: Sustainable food systems and quality

5b.1
Migration and sensory effects of active packaging compounds in food

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Introduction: Active packaging was developed as a new technology to preserve food. It interacts with foods, can increase the shelf life of perishable foodstuffs, and maintains or improves the quality and safety of food products. Generally, active films and coatings contain a biopolymeric matrix incorporated with active compounds. Active compounds are applied in two ways: (1) directly into a polymer matrix or (2) placed in a packet (sachets and pads). Sensory analysis is a crucial aspect of food quality. The use of active packaging demonstrated to preserve food without affecting sensory properties (color, texture, odor, overall acceptability). However, the researches performed on the use of taste panels are limited.
Aims: This work aims to give an overview of both the migration and sensory effects of active packaging compounds in food. Biopolymeric matrices incorporating nanoparticles, essential oils, natural extracts, and other active compounds were selected for this study to evaluate migration and sensory aspects.
Results: There are limited studies regarding the migration of active compounds into packaged food. Most of the migration analysis was done into food simulants (distilled water, acetic acid, ethanol) and not in food matrices. Migration aspects of active packaging containing metal nanoparticles were more studied than other active compounds. Most of the existent studies regarding the sensory evaluation of packaged or coated food products were done for meat and fish matrices and a few for vegetable and fruit matrices. Generally, bioactive materials used for active packaging improved or maintained sensory attributes of perishable foods. Chitosan biopolymer incorporating active compounds is present in most of the manuscripts which include sensory analysis of both active coatings and active films in food matrices
Conclusion: Both migration and sensory aspects of active packaging compounds into food matrices request more research.
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5b.2

Nanosystems for the essential oils delivery - current perspective

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There is a growing interest and demand from nowadays consumers for food products that on one hand contain bioactive compounds that can promote health but also for products that have all-natural ingredients. In this context, the research in the field of essential oils (EOs) possible uses as natural antimicrobials, flavorings and antioxidants has increased. EOs are plant secondary metabolites, containing different classes of bioactive compounds (e.g. terpenes and terpenoids, phenolic compounds, esters, aldehydes) that can be extracted from the different parts of the plants (flowers, leaves, fruits, stems, roots, etc.) by classical hydro-distillation or by other new green extraction methods. Due to their complex composition, the EOs exhibit a wide range of biological activities, including antioxidant, antimicrobial, anti-inflammatory or antidiabetic properties, supported by numerous scientific studies. Nonetheless, their use in food products is still limited by several drawbacks such as high volatility, hydrophobicity, strong flavor or sensitivity to external factors (light, oxygen, humidity, temperature). To overcome these shortcomings, one of the most promising strategies is the incorporation of EOs within a colloidal delivery system. In our research, we focused on the development of several formulation strategies for the encapsulation of EOs in nanostructured systems, having the final goal to ensure the protection of the bioactive compounds and their controlled release, to enhance their bioavailability and hence their effectiveness in the food products. The advantages as well as the main challenges of the encapsulation of EOs in lipid-based systems (e.g. nanoemulsions) and carbohydrate-based nanocarriers (e.g. chitosan) are assessed and their suitability in terms of encapsulation efficiency is discussed. **Acknowledgement.** This work was supported by a grant of the Romanian National Authority for Scientific Research and Innovation, CNCS-UEFISCDI, project number PN-III-P4-ID-PCE-2020-1847.

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5b.3

Apple by-products - a potential substrate in sourdough fermentation

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Food demand has increased due to urbanization, population growth, and income growth, and meeting its sustainability remains a major global challenge in the long run. One of the most worrying industries is apple juice, which generates a massive volume of waste, given the annual processed tonnage of up to 12 million tons (Mt) every year. In contrast, the low cost and high abundance of this waste highlight the economic prospects of its potentially valuable components. Apple (*Malus sp.*) Is one of the most popular fruits in the

world. Global production has over 87 Mt in 2019 compared to 1990, where just over 47 Mt were produced. In addition, global production is expected to grow steadily in the coming years. The circular economy goes beyond the limits of environmental sustainability, emphasizing the idea of transforming products so that there are viable relationships between ecological systems and economic growth. Therefore, the present work aims to capitalize on food by-products, apple pomace (AP), and integration into a continuous flow of food biotechnological processes. This paper integrates the performance of traditional dough enriched with PA and fermented by lactic acid bacteria and yeast (mono- and co-cultures). The use of agro-industrial by-products could provide an additional source of income and, at the same time, help reduce the problem of eliminating by-products and increase the nutritional profile of fermented foods. However, due to the results reported in this study, the food processing industries are expected to better manage their by-products and waste, thus avoiding a growing environmental problem. By-product management is challenging in order to use them efficiently considering, their necessity to be dried quickly before damage. In this work, the drying with hot air stream was applied, which can be used economically on a commercial scale to transform the by-products into dry form. From 271 kg of apple, 58.24 kg of AP (peel, seeds, and stem), and 212.8 kg of juice have resulted. In addition, organic acids before and after drying were analyzed from AP. Also, the AP flour was integrated into a sourdough fermentation. In this study, new insights are provided into the evolution of AP-based sourdough fermentation. The wheat flour and AP flour were mixed at different ratios, hydrated with water (1:1 w/v), and individually fermented using *Lactobacillus florum* DSM 22689 and baker's yeast. Sourdough fermentation was monitored and analyzed: pH-value, viability, and HPLC. A benchmark of scenarios regarding AP integration in new sustainable food systems emerges, based on these results. AP by-products at 5% and 10% were the ingredients used to fortify a traditional sourdough fermentation with specific LAB and yeast. During sourdough fermentation, the nutritional value increases, highlighting a new approach that could guide innovative fermented foods. Firstly, AP flour had a positive effect on cell viability, with constant growth, especially in fermentations with 95% WF and 5% AP. Second, APs are a rich source of glucose and fructose with increased bioavailability, a cheap carbohydrate source for LAB and yeasts. Third, AP contains significant amounts of organic acids like oxalic acid, malic acid, and citric acid.

5b.4
Can kiwifruit grow in Romania? Results of the Romanian breeding program after 25 years of research on *Actinidia spp.*

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Domesticated from wild populations located on Yangtze River basin, kiwifruit is a recently developed crop and only within the last 70 years started to be commercialised. In Romania, kiwi is a new fruit specie and the creation, testing and introduction of winter hardy genotypes, adapted to the local harsh climate conditions represent a priority. The first kiwifruit orchards with *Actinidia deliciosa* and *A. arguta* were planted in Romania in 1993, at Ostrov (Constanța County), on the border of the Danube River. In the same year, a common Italian-Romanian kiwifruit breeding program was initiated at the Faculty of Horticulture within the University of Agronomic Sciences and Veterinary Medicine of Bucharest. The experimental field with kiwifruit hybrid genotypes, was established on chernozem black soil in the Romanian plain, using some hybrid seedlings. The plants were grown under an organic orchard management, on a T-bar trellis system. The inter row surface was covered with a mixture of perennial grasses and mowed mechanically, and along the row, the soil was kept clean. Drip irrigation and micro spray irrigation system was provided. Since 1993, research has been carried out to determine the best methods of propagation, growing and kiwifruit orchard management. Genotypes phenology was studied every year in comparison with the climatic data. In parallel, physical and biochemical fruit characteristics were evaluated after ripening and during the storage. In time, several hybrid genotypes were obtained by free and controlled crossings between different cultivars of *A. arguta*: Francesca, Rosana, Jumbo, AA2, AA5, AA 6, AA 8 and the male ARM. The first flowers and fruits from *A. arguta* hybrid plants were produced in 2001 and selection has continued since then. After some years of observations and tests, eight elite female plant with interesting fruit characteristics were chosen for

propagation and testing under commercial orchard conditions. From this, three kiwiberry selections were registered: 'Vip Green' (R8P23), 'Vip Red' (R8P20) and 'Green Delight' (R8P1). Other intra and interspecific crossings using *A. deliciosa* and *A. chinensis* were made and from the initial hybrids, some selected genotypes as R0P13, R1P9, R1P8 and R1P12, have good fruit characteristics and yield. The new selections have to be registered as cultivars and can be successfully cultivated on commercial orchards and in private gardens. This paper presents few results of the *Actinidia spp.* Romanian breeding program. Some fruit quality characteristics of the new kiwi selections and hybrids as average weight, fruit shape index, pulp firmness, soluble solids, dry matter, acidity and ascorbic acid are detailed. After more than two decades of research, it was demonstrated that *Actinidia deliciosa* and *A. chinensis* can be grown in Romania in peach favourable areas, while *A. arguta* (kiwiberry or baby kiwi) can cover larger areas, suitable for plum cultivation.

5b.5
Elaborating the Baltic Sea Region principles of sustainability in public catering: a case study of the third most polluted city in Poland and the impact of its participation in the Interreg-BSR project StratKIT

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The aim of this paper is to present the European principles of the sustainability in public catering, developed during an Interreg project StartKIT due to the knowledge and experience exchanged, innovative co-workshops, conferences and collaboration between six Baltic Sea Region (BSR) countries. First step of the research has been the evaluation of the city of Rybnik situation in the field of sustainability in public procurement and catering services. Rybnik, one of the Polish project partners, is situated in the south of Poland, in Silesia Province. This region is highly polluted due to hard coal mining and heavy industry, and the public catering answers to the customs of its citizens: heavy Silesian cuisine, rich in meat and the skepticism for modern plant-based meals connected to the evident lack of the food and environmental education and misunderstanding of the sustainable actions for change.After describing the issues of the local and national public catering services, it outlines the number of the possibilities for the city to follow the direction of the sustainability, reaching to the successful examples of a greener, Baltic Sea Region partner countries.This case study analyses the results of the partners collaboration in the project, all of the co-innovative workshops and conferences findings, successful good practices and growing network of local, national and European stakeholders. In the next stage, based on all of this input, the principles of the sustainability in the Baltic Sea Region public catering are being elaborated. This case study identifies universal tools and a framework for sustainable diet introduction, increasing sustainable and organic food and, at the same time, diminishing food waste in public catering.The common principles are defined from the BSR tree-shaped framework models, displaying through growing roots, trunk and branches, the national situations of the sustainability in public procurement and catering services. Through the work and development of the project, the trees are being modified and they are becoming illustrations for the sustainability options and a transferable framework for similar units to copy.The Rybnik case shows how in the city where children's exposure to black carbon is over four times higher than their European peers, the BSR harmonised voluntary sustainable procurement and catering service principles are being gradually introduced. Starting from environmental education, supporting sustainable meals, organic farming, motivating the implementation of Green Public Procurement criteria, training and encouraging canteen personnel to serve real, nutritious, organic and tasty meals while consequently limiting food waste. The implementation of the project BSR principles is presented during Rybnik's pilot activities - in the social care home, and in the primary schools where food waste measurement, culinary workshop and sustainability lectures have been taking place.The research conducted in the StratKIT project has been very promising, both on local and national and international level and can complement the European policy for a greener planet and healthier society.

POSTER PRESENTATIONS

Poster session 1: Modern agriculture (new challenges in plant and animal sciences, biotechnologies)

P1.1
The effects of BioR and Fosprenil remedies on the functional state of the liver in female rabbits during the reproductive cycle

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Rabbits breeding represents a new branch of zootechnical sector which provides diet products for humanity. In this context, the study on the action of the national product on rabbits' liver's functional state represents a real interest. The study was conducted on 3 lots of 7 rabbits, each for a period of 80 days. The rabbits from the control group were administered 0.9% NaCl at a dose of 1.0 ml per capita, whereas at EG 1 and 2, the BioR and Fosprenil remedies. The remedies used in the study were administered twice, intramuscularly, in the beginning of the study with 5-7 days until the mount and at the 14th day of gestation. Both bioactive products were well tolerated by rabbits, as well as their offspring, a fact confirmed by the body temperature, pulse and respiratory movements in animals. The biochemical investigations have highlighted the beneficial action of the BioR remedy, as well as of the alternative product Fosprenil on the functional state of the liver in rabbits during the periods of high metabolic demands, such as gestation and lactation. It has been demonstrated that on the 7th day after parturition, the ALT and AST enzymes are lower in animals treated with BioR remedy compared to CG ($p < 0.001$).At this experimental stage, the tested remedies induce a decrease in the total serum bilirubin: in EG 1, with BioR by 14.6% ($p < 0.01$) and in EG 2, with Fosprenil by 3.9% compared with the CG. The activity of alkaline phosphatase at 14 days of gestation exceeds the initial values of the CG (by 37.5%, $p < 0.01$). It is significant that the tested remedies maintained and amplified this physiological tendency. Thus, the parameter investigated at the EG was 2.4 times higher compared to the control group ($p < 0.001$). Positive results were registered also 1 week after the parturition, when the AF in the CG continues to increase (+ 31.8%, $p < 0.05$), which in our opinion is a delayed but beneficial tendency. The positive manifestation is seen in the EG, where the research index decreased significantly by 1.3-1.4 times, compared to the previous research ($p < 0.05$, EG 2; $p < 0.01$, EG 1). Simultaneously, the cure used with the studied remedies is also reflected in higher values of the activity of this serum enzyme by 26.3-34.9% compared to the control group. At the end of the study, the analysis of the AF activity in the serum shows a positive and accurate tendency to diminish it 1.8-2.2 times in all groups, compared to the 2nd research ($p < 0.01$, CG and $p < 0.001$ for EG). According to the data obtained in the last stage of research, the value of AF has a double connotation: a) it practically does not differ between the groups in this study (+ 8.4-9.9% in EG), compared to the CG; b) are located at the level of normal physiological parameters, which certifies the health of animals, especially the liver and the possibility of their use in the new reproductive cycle.Moreover, the BioR remedy reflected specific properties of stimulation of the proteosynthetic function of the liver, a phenomenon justified by the true increase in serum ($p < 0.05$) of the pseudocolinesterase (PCE) at all stages of investigation, confirming the beneficial impact of the BioR remedy on the liver in rabbits during the reproductive cycle.The obtained results are also justifiedbythe reproductive parameters which were higher than in the female rabbitst reated 2 times in a row with the BioR product, obtained with modern technologies from Spirulina platensis.

P1.2
The role of selenium in oxidative stress, disorders caused by excess or deficiency of Se in humans and animals

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Selenium (Se) - a chemical element that was once known as a toxic substance, now - an important component of enzymes active in regulating the effects of oxidative stress. These enzymes are included in

the protective processes of cells against the action of reactive oxygen species (ROS) - responsible for cellular transformations which can contribute to carcinogenesis. Se has an effect on modifying the body's immune response by participating in processes for removing ROS, inhibiting cell proliferation, regulating thyroxine levels, protecting DNA from oxidative damage caused by mutagene and carcinogens. In most parts of the world there is a deficiency of Se, which has serious health implications: lowering immunity, the risk of many diseases (cancer, heart disease, muscular dystrophy, diabetes, arthritis). In humans, Se deficiency can lead to disease units such as Keshan and Kashin-beck's disease, occurring in areas of China. Scientists have proven that selenium deficit in feed can also affect many diseases and disorders in animals, such as nutritional muscular dystrophy or heart disease. The concentration of Se in feed diets must be under control as its excessive amount may cause poisoning, called selenosis. This disease affects all animal and human species, causing, among other things, apathy, skin lesions, respiratory failure, cirrhosis of the liver, decreased weight gain, hoof dystrophy and in birds embryo deformation and low hatching levels. The results of many studies on Se levels and its effects on the functioning of the body confirm that the optimal amount in the diet is necessary for the proper functioning of all organisms. Selenium plays a key role in many metabolic processes, which is why its proper supplementation is such an important issue.

P1.3
Genetic characterization of crucian carp (*Carassius carassius* L. 1758) populations in Hungary using microsatellite markers for conservation

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Crucian carp (*Carassius carassius* (L. 1758)) is a *cyprinid* fish native to Central-Eastern-Europe including Hungary. The populations of this species are declining in Hungary and neighbouring countries mainly due to human activities, hybridization and invasion of other closely related fish species that are not-native to these habitats such as gibel carp (*Carassius gibelio* Bloch, 1782) which has been considered as one of the most successful invaders of the native fish communities and thus impact the natural habitats and spawning grounds. Their role in aquaculture is of limited importance at present, but climate change may increase their importance in Hungarian aquaculture. In order to preserve the indigenous populations of Hungarian crucian carp, it is necessary to perform a genetic study using genomic and mitochondrial DNA markers to obtain information regarding the genetic background of this species. Population genetic diversity is poorly understood for this species; this is, however, one of the first studies to report genetic differentiation of native Hungarian crucian carp populations. In the present study, thirteen microsatellite markers (MFW7, GF1, GF29, YJ0010, YJ0022, HLJYJ017, HLJYJ028, HLJYJ029, HLJYJ041, HLJYJ046, HLJYJ082, J62 and CypG24) were used to test the level of genetic variability on 336 individuals of eleven crucian carp populations, representing 7 wild populations and 4 stocks from different fish farms in Hungary. The results showed that all microsatellite loci had high levels of polymorphism, with a total number of 245 alleles in all populations. The number of alleles ranged from 61 to 133 in different populations along with a total of 49 private alleles with the frequencies ranging from 0.016 to 0.250 respectively that are mostly found in the wild populations. The lowest number of alleles was found on locus GF1 (3) while the highest number of alleles (75) was detected on HLJYJ041. The mean observed heterozygosity across all loci within a population ranged from 0.385 to 0.619, and the average observed heterozygosity (Ho) and expected heterozygosity (He) for all populations was 0.509 and 0.551 respectively. From the He and Ho values, it was inferred that in most of the natural populations these two values were close to each other while in case of two farmed stocks (NBGK-HGI stock, HAKI stock) the Chi-square test for Hardy-Weinberg equilibrium presented significant heterozygote deficit in six of the thirteen loci. General F-statistics (Fis, Fit, Fst) were also calculated. Pairwise FST from low to high values (0.014 - 0.455) showed a robust structure and significant level of population differentiation. Bayesian model-based clustering (STRUCTURE) analysis has consistently confirmed the existence of three sub-populations within the eight native populations that are

described as being genetically pure. The analysis of molecular variances (AMOVAs) revealed that 20% of the whole molecular variance is among populations, while 16% is among individuals, and 64% is within individuals. We concluded that there are moderate to high genetic differences in the populations of Hungarian crucian carp and the natural populations generally have higher variability. Two wild populations Dunafalva and Kölked (close to Danube River) showed low variability and were homogenous in their genetic structure without genetic admixture events. These are completely isolated pond populations with a small number of individuals probably due to the previous occurrence of a founder effect, those ponds with little or no mixture have great potential to serve as future stocks for native crucian carp populations. The extent of the hybridization with gibel carp is also in the focus of our research. Hybrids with Prussian carp must be detected and excluded from genebank activities, thus in the next stage of the research study, different mitochondrial DNA markers will be involved.

P1.4
Effect of phytonutrients apigenin and resveratrol on secretory activity and viability of human ovarian cells *in vitro*

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Biologically active substances such as polyphenols and flavonoids have potentially high antioxidant and anticancer activity. Apigenin and resveratrol are phytonutrients that occur in various fruits, vegetables, herbs, and others. Human ovarian granulosa cells (HGL5) as the sites of estrogen and progesterone production and human ovarian carcinoma cells (OVCAR-3) were used as a cell model for *in vitro* study. The aim was to examine the potential effects of apigenin and resveratrol on the secretion of steroid hormones by HGL5, cell viability of HGL5, and OVCAR-3. Cells were grown in culture for 24 hours without (control group) or with treatments at the concentrations 0.625, 1.25, 2.5, 5, and 10 µg/ml, or with 0.1 % DMSO (as positive control). The release of progesterone and 17β-estradiol was monitored by enzyme-linked immunosorbent assay (ELISA) and metabolic activity of the cells was assessed by Alamarblue™ cell viability assay. The significance of differences ($P \leq 0.001$) between the groups was evaluated by one-way ANOVA followed by Dunnett's multiple comparison test. The secretion of progesterone and 17β-estradiol after the addition of apigenin and resveratrol was not significantly affected. Similarly, the number of viable cells was not significantly affected after the addition of apigenin and resveratrol in HGL5 cells. On the other hand, the viability of OVCAR-3 cells was significantly ($P \leq 0.001$) decreased after the addition of apigenin and resveratrol at the highest used concentrations 5 and 10 µg/ml but not at 0.625, 1.25, 2.5 µg/ml. In conclusion, the results of our *in vitro* study examined the potential dose-dependent and cell-specific effect of biologically active substances such as phytonutrients apigenin and resveratrol in human cell lines.

1.5
Ozone as a new control strategy for storage systems pest

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Ozone (O_3) is a strong oxidant with a long history of safe use in many fields such as agricultural sector, food, textile, industrial and paper sectors, in the disinfection of water (drinking water and in the processing of waste water), etc. Environmental friendly properties are its main advantage compared to traditional pesticides and fungicides. It can be easily generated at treatment site by using only electricity and air. Therefore, O_3 usage has following safety advantages over conventional pesticides: there are no residues on products or within products; no presence of toxic chemicals; no hazards of plant protection product mixtures; no issues with disposal of insecticide leftovers and no disposable packaging. Insect infestation within commercial storages are a major concern for food industry. The presence of insects and their remains in grain and stored food may pose a serious health risk to humans and livestock. In most cases, in commercial storages pests are managed by a combination of different methods such as cleaning and cooling, fumigation or treatment of the stored material with contact insecticides. Available pesticides for treatment of grain and other stored products are decreasing due to environmental and safety concerns among consumers and society. Thus the need for alternative pest control methods is rising. The use of O_3 is one of the potential methods although the ozone mode of action on insects is not completely known. Insect´s respiratory system is most likely a target spot since it is a respiratory toxicant. The main goal of this investigation was to determine efficacy of ozone in the suppression of insect pests. The investigation has been conducted on seven different insect species which were in different growing stages (adults: *Sitophilus granarius, Blatta lateralis, Blaptica dubia, Gryllus campestris*; larvae: *Pachnoda sinuata flaviventris, Tenebrio molitor i Zophobas morio*). Different exposure durations to ozonation process were tested. In addition to ozone efficacy, the walking response time and velocity of *Sitophilus granarius* were investigated. The results showed promising ozone effects on insects' ability to move by slowing down response time, decreasing velocity or finally causing mortality. The highest efficiency of ozonation has been determined on adult insects' stages while efficiency of larvae treatment had very low or no effect. Ozone efficiency increases with time of exposure. Above mentioned ozone features can be used in storage system providing a realistic choice in pest control either as a suppressant or a means of disabling movement which would ensure extended time for target application of treatment.

P1.6
Advanced and predictive agriculture for resilience to climate change

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Climate change is one of the greatest concerns of today's world and has significantly altered or is continuously altering Earth's ecosystems. It can be explained as the phenomenon involving changes in environmental factors like temperature, humidity and precipitation through a long period of time. The unprecedented temperature rise has resulted in increased events of droughts, floods, heat waves and other extreme weather conditions on a global scale. Far reaching effects of climate change are now greatly visible on agriculture sector, on which relies the food production, food safety and economy of the most parts of the world. Current and future climate change is projected to have significant impact on the cultivation of agricultural crops resulting in lower yields and higher costs. Climate change also have notable impact on pests of these agricultural crops by influencing their reproduction, development, survival and spread as well as the relation between pests and their environment. As a significant driver of agricultural crops and their pest population dynamics, climate change will require adaptive management strategies. This means that we need to take proper measures to mitigate harmful effects of climate change and adapt to its consequences. In order to do so, the key is transition to sustainable and modern agriculture which must be driven by new technologies, research and innovation. In 2020, the European Regional Development Fund has supported the project "AgroSPARC - Advanced and predictive agriculture for resilience to climate change" which is carried out by the Innovation Centre Nikola Tesla, Faculty of Electrical Engineering and Computing and the Faculty of Agriculture at the University of Zagreb in Croatia. Therefore, the key priorities of this project are building resilience and adapting to present and future climate risks. The main focus of the project is to use artificial intelligence to develop mathematical models for different phenophases of wheat and use these models to forecast crop yields and forewarn of insect pests in the terms of climate change predictions. Analysis of a large data sets will be carried out in relation to various climatic conditions, which will be artificially generated and permuted in prototype climate chambers. These data sets will be correlated

with established indicators of wheat growth and development at different phenophases and different intensities of the insect pest infestation. A system based on artificial neural networks will be developed. Artificial neural networks classify and select data on climatic conditions in prototype climate chamber, real-time weather forecasts and indicators of crop development and then learn and verify numerical models of different phenophases of wheat based on large experimental data sets. This activity involves determining neural network structure; inputs, outputs, number of different layers, number of neurons per layer, etc. When determining the structure, the available domain knowledge in agronomy is expected to significantly increase the efficiency in the implementation of activities and reduce time frame for obtaining results as well as the accuracy of the final results. The mathematical models will be available publicly and interactively via an online portal to forecast different phenophases of wheat and forewarn of the most significant insect pests of wheat under real and hypothetical climatic conditions.

P1.7
Risk factors affecting the occurrence of stillborn calves in Holstein dairy cattle

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In modern dairy cattle farming, stillbirths cause significant economic losses for producers. With proper management of the herd, these losses could be significantly reduced. For that reason, this study aimed to examine the effects of the following categorical risk factors on the occurrence of stillborn calves in Holstein dairy cattle: sex (male/female), housing system (free/tied), season (autumn/winter/spring/summer), year (2015/2016/2017/2018/2019), twins (yes/no) and continuous risk factors: gestation length, age of cow at calving and weight of calves at calving. Examination of the effects of these factors was performed using multiple logistic regression. Statistical analysis was performed using R v4.0.0 in RStudio. The data taken for this analysis covered the period from October 1, 2015, to September 30, 2019, from two Holstein cattle farms in Serbia, which differed in the housing system (free/tied). In this study, a stillborn calf was considered to be a calf that died immediately before, during, or within 24 to 48 hours of birth, and only in cases when the mother's gestation length lasted more than 240 days. The final database consisted of data for a total of 5736 calves. Of the total number of calves observed, 94.02% were liveborn, while 5.98% were stillborn. Two models were formed. In the first model, all the listed factors were included. After statistical analysis, it was concluded that that only sex ($p<0.001$), gestation length ($p<0.001$), age of cow at calving ($p<0.01$), and weight of calves at birth ($p<0.001$) statistically significantly contribute to the model for predicting the probability of occurrence of stillbirths. After that, a new model was formed that included only statistically significant factors. Using the likelihood ratio test, a chi-square value ($p> 0.05$) was obtained, based on which it was concluded that the final model fits the data as well as the initial one. By comparing the AIC values of both models, it was found that the final model with 4 variables has a lower AIC value of 2381.8, compared to the AIC value of the initial model which was 2394.4. Based on this indicator, it was concluded that the final model was better for predicting the probability of stillbirths. Odds ratios for sex, gestation length, age of cow at calving, and weight of calves at birth were: 0.5576, 0.9172, 1.0003, and 0.9616, respectively. The model showed that the chances of a calf being stillborn are 44% lower for female calves compared to male calves, that with every day of increase of the length of gestation increases, the chances of a calf being stillborn decrease by 8.28%, that with every day of increase of the mother's age at the birth of a calf the chances of a calf being stillborn increase by 0.03% and that with every kg of increase in the weight of the calf at birth the chances of a calf being stillborn decrease by 3.84%, holding the other variables constant. The obtained results can help breeders to make the right decisions and optimize conditions on farms in order to influence the factors under their control and reduce the appearance of stillborn calves to a minimum, thus reducing economic losses and increasing their income.

P1.8
Germination response of common ragweed (*Ambrosia artemisiifolia* L.) at low temperatures

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Ambrosia artemisiifolia L. (common ragweed) is widespread weed species present for more than 70 years in Croatia with high density occurrence in row crops and ruderal areas. Besides negative agricultural effects, common ragweed pollen causes significant health problems to approximately 15% of the Croatian population. Although defined as thermophile summer annual, in the last few years in the northwest part of the country, seedlings have been observed even in the fall (November) and in the middle of February in overwinter wheat. Since the timing of emergence contributes to the dynamics of further phenological stages (pollen and seed production), the laboratory experiment aims to investigate the possibility of common ragweed germination at lower temperatures than the optimum one. Five replicates of 50 seeds were sowed in Petri dishes with the addition of 2 ml of deionized water and placed in the gemination chamber. Germination was tested simultaneously at different temperatures: 25 (control), 1, 3, 6, 9 and 12 °C with photoperiod 12h:12h (day: night). Germination was recorded once a day for seeds set on 6, 9, and 12 °C and once a week for seed set on 1 and 3°C to avoid entering heat (room temperature) into the chamber. Germination was defined as 1 mm of radicle protrusion and germinated seeds were removed from the Petri dishes. Recording was conducted until no further germination occurred for 10 days. Percentage of final germination and cumulative germination at different temperature data were subjected to ANOVA in SAS with Fisher`s protected LSD ($\alpha \leq 0.05$). The germination time course was analysed using a logistic function in the Bioassay97 program. Germination time course was used to define time necessary for germination of 10 (t_{10}), 50 (t_{50}) and 90 % (t_{90}) of germinated seed. Results show common ragweed germination at each studied temperature with the highest percentage of germination (67.6%), as expected at 25 °C (control). The lowest germination was found between 6 to 12 °C (49.6 - 40.4%). Between the highest (25 °C) and the lowest studied temperature (1°C) (59.6%), no significant differences were found. However, germination dynamics (t_{10}, t_{50} and t_{90}) differed considerably between the two studied temperatures. At 25 °C germination test lasted (t_{90}) for one week while at the lowest temperature germination lasted for 165 days (d) The fastest initial germination (t_{10}) at lower temperatures was achieved in 15 d at 12 °C, while the slowest initial germination was determined in 84 d at 1 °C. The fastest medium (t_{50}) and final (t_{90}) germination was at 12 °C (46 d), 9 °C (42 d) and 6 °C (46 d). The slowest medium and final germination was at 1 °C (120 - 160 d). Results of the experiment suggest that the germination of common ragweed is possible even at 1 °C when exposed to constant temperature and moisture longer period (approx. 5 months).

P1.9
The profile of selected antioxidants in two courgette cultivars from organic and conventional production

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Courgette fruits, which belong to *Cucurbitaceae* family, are in high interest for producers, processors as well as consumers. Courgette is considered as a low-calorie vegetable with health-promoting properties. The profile of antioxidants in other cucurbits are known, but research focused on the profile and content of bioactive compounds in courgette as well as the potential fruit quality modulating factors, are rare. Due to the high adaptability of courgette to weather and agronomic conditions, it is produced on a global scale. Both producers and consumers are looking for food with values that promote health. Moreover, current research confirms the positive effect on plants quality incident to using organic farming practices. The aim of this study was to analyse the impact of organic versus conventional agronomic practices on the concentration of selected antioxidants in courgette fruits. Fruits of two courgette cultivars (Astra Polka and Nimba) produced in an organic and conventional system were tested by high performance liquid chromatography (HPLC) to determine the content of polyphenols (flavonoids and phenolic acids),

carotenoids (lutein, zeaxanthin and *β*-carotene), chlorophylls (chlorophyll *a*, chlorophyll *b*), and vitamin C (L-ascorbic acid, dehydroascorbic acid). Organic courgette fruits were characterised by their significantly higher content of phenolic acids and flavonoids as well as carotenoids (sum) when compared to the conventionally grown fruit. Next to the production system, the year of cultivation was the significant factor affecting the content of bioactive compounds. The organic cultivation might be a good method to increase concentration of bioactive compounds with antioxidant properties in courgette fruits. Nevertheless, the identified trends should be further confirmed, with attention paid to other courgette cultivars, as well as to the potential interactions between the plant genotype, agronomic system and the location-specific growing conditions.

P1.10
Perspectives on further breeding of *Hippeastrum ×chmielii*

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The genus *Hippeastrum* Herb. belongs to the family *Amaryllidaceae*, and in commercial cultivation there is *Hippeastrum hybridum* hort., which was obtained by crossing several species (*H. vitatum, H. leopoldii, H. reginae, H. aulicum, H. pardinum*). The genus includes 50 to 80 taxa found in South American countries. *Hippeastrum* is cultivated as a flowering pot plant as well as a cut flower, year after year the demand and the cultivation area is increasing. In the Dutch auctions, more than 70 million flowers were sold in 2012. The main objective of the breeding programmes is to improve the decorative value of the flowers and their resistance to high temperatures. Data on new cultivar registrations, of the Dutch Royal General Bulb Growers' Association (KAVB) from 2015-2019, shows that as many as 113 new cultivars have been registered. The largest number of registered cultivars (43) belong to the „Galaxy" group with very large flowers over 16 cm in diameter. The directions of research will include the possibility of obtaining new flower colors - yellow and violet, as well as increasing the use of molecular biology tools for further understanding of the genetic structure and, consequently, their use for improving *Hippeastrum* cultivars. In Poland, at the Warsaw University of Life Sciences (SGGW), *Hippeastrum ×chmielii*, a new hybrid characterized by vigorous growth, high vegetative propagation rate, and lack of a dormancy period, was bred in 1993. Two clones (Nos. 6 and 18) were used for further creative breeding. The aim of this study is to select and evaluate selected promising individuals from these crosses. In the first stage, the viability of pollen grains was verified by the acetocarmine staining method, as well as the possibility of pollination and fertilization of *H. ×chmielii* flowers of clones 6 and 18 by applying pollen to the stigmas of pistils of three H. hybridum cultivars - 'Gervase', 'Rio Negro' and 'Royal Velvet'. Seventy-two crosses were made in 6 combinations. The percentage of germinated seeds ranged from 48.3 to 77.9%, depending on the type of crossing. The resulting seedlings were grown in a greenhouse, where 180 plants flowered in the second year of cultivation, representing 6% of the total population. Young plants form numerous adventitious bulbs, and mass flowering is expected in 2021. Promising individuals will be selected for morphological and genetic evaluation and micropropagation studies. In 2020, the parental forms were subjected to cytogenetic studies, the results of which indicate that *H. ×chmielii* clones and cultivars 'Gervase', 'Royal Velvet' are tetraploids (4n=44), only cultivar 'Rio Negro' is diploid. Genome size was also checked by flow cytometry - 2C DNA content for *H. hybridum* 'Rio Negro' was 30.6 pg, for 'Royal Velvet' - 54.1 pg, and for *H. ×chmielii* clones 6 and 18 - 55.0 pg and 54.6 pg, respectively. The obtained results confirm the ploidy level of the studied genotypes determined on the basis of the number of metaphase chromosomes. In the case of cultivar 'Gervase', it turned out that it is a mixoploid containing two genomes - one tetraploid (54.7 pg), which confirms the previous study on the number of metaphase chromosomes, and the other - aneuploid (45.4 pg).

P1.11
Screening cucumber germplasm for low temperature seed germination ability

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Cucumber (*Cucumis sativus* L.) is an economically important vegetable cultivated worldwide. Due to its subtropical origin, cucumber is sensitive to low temperatures, especially during seed germination and early growth of the plants. Cold stress may severely affect cucumber seed germination, delay seedlings growth and cause chilling injuries, what may result in limitations of plant performance and low yield. Therefore, cold tolerance is an important trait of cucumber varieties that are developed for open-field production. The aim of this study is to find and characterize new sources of cold tolerance in cucumber. For this purpose screening of cucumber germplasm for low temperature germination ability was initiated. Seeds of 171 cucumber accessions from Polish National Gene Bank IHAR Radzików were obtained. As a negative control cold sensitive line B10 was used. To increase seeds plants were grown and self-pollinated at the plastic tunnels at Experimental Station Wolica (WULS-SGGW). Based on preliminary experiments and literature a protocol to test low temperature seed germination ability was established. For each accession, 30 seeds were placed on three layers of filter paper moistened with 15 ml of water and paper was rolled-up. Next rolls were placed in tightly closed plastic boxes and incubated in the dark at 13°C in plant growth chamber (MLR-352, Sanyo/Panasonic, Osaka, Japan). The test last for 14 days. On the day 6 and 14 after seeding germinating seeds were counted. After the test the seeds were placed in an incubator set at 28°C in the dark for 7 days to confirm that cold was the only factor inhibiting seed germination.. The first results were obtained. Seeds of 13 out of 171 examined accessions were characterized as capable to germinate at low temperature, with germination ability >91%, and for four of these accessions 100% cold germination was noted. Seeds of all accessions germinated at the optimal conditions. Identified in this study low temperature germination accessions will be further characterized and used to investigate genetic basis of cold tolerance in cucumber.

P1.12
Mass use of *Fusarium* resistance linked markers in resistant breeding of head cabbage (*Brassica oleraceae var. capitate*)

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Fusarium yellow is a destructive fungal disease which causes significant yield and quality loss in cabbage. Use of resistant varieties is the most effective strategy to control the effect of *Fusarium*. Marker assisted breeding makes resistance breeding by reducing the time taken in conventional resistance breeding. Several markers, linked to the gene (FOC1) associated with Type A *Fusarium* resistance have been identified by different study groups using double haploids or inbred lines and includes Insertion-deletion (InDel) markers, simple sequence repeat markers (SSR), single nucleotide polymorphisms (SNP) markers. Some markers help to detect homozygous and heterozygous of the resistant gene which helps selecting parent plants for breeding. Mass practical applicability of few selected markers, developed by previous studies were tested using nine commercially available *Fusarium* resistant F1 hybrid head cabbage cultivars and one Fusarium susceptible Czech traditional cabbage cultivar. Five different markers, M10, A1 (InDel markers), Frag 13 (SSR marker), FOCBNU (SNP marker-universal) and Bol037156 (DNA marker) were selected for the analysis. Physiological resistance was evaluated by inoculation test, the root-dipping method in conidial suspension (1×10^6 conidia/mL) of *Fusarium oxysporum* f. sp. *conglutinans* and 30 days old seedlings. Molecular marker assay was carried out by PCR with isolated DNA from the same seedlings used for physiological resistance analysis. Percentage of accuracy of tested markers were varied but showed significant consistency and correlation with the phenotype assay in resistant cultivars and susceptible cultivar proving the reliable mass applicability in *Fusarium* resistant breeding in cabbage.

P1.13
Genetic & morphometric monitoring for management of western corn rootworm resistance

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The western corn rootworm (WCR) is a highly invasive pest of maize. It has developed resistance to insecticides and established management strategies. The objective of this study is to determine the differences between WCR laboratory populations from the United States that are resistant to various Bt toxins and non-resistant population by combining genetic and geometric morphometric analyzes. For the morphometric analyzes, 775 hindwings of Bt-resistant and susceptible WCR populations from laboratory cultivation in the USA were used. Fourteen specific points (markers) were used to assess variability in hindwing shape and size. Principal component analysis (PCA) and canonical discriminant analysis (CVA) were used. The research results showed significant differences in US populations resistant to different Bt toxins. To confirm these results, we used the single nucleotide polymorphisms (SNPs) method for detailed whole genome analysis. Forty-five WCR individuals were genotyped. Individuals were subjected to standard population genetic analyzes, and the resulting genotypic data were analyzed for: expected (H_E) and observed (H_O) heterozygosity, FIS, and θ (F_{ST}) to determine the alteration of individual alleles as a possible consequence of mutations and the development of resistance to some of the Bt toxins. After quality filtering of the SNP data, we retained 7,229 SNPs for further data analysis. Preliminary results based on the one-population model showed moderate observed heterozygosity ($H_O = 0.3206$). Moderate genetic diversity estimated by expected heterozygosity ($H_E = 0.302$). Moderate inbreeding was also observed ($F_{IS} = 0.1271$). There were no significant deviations from HWE on all loci. The low value of pairwise $F_{ST} = 0.0179$ suggests a lack of genetic differentiation and structuring among the putative populations. The use of these modern and innovative techniques (i.e., SNPs and geometric morphometrics) to detect resistant variants is a completely novel approach and provides new insights into a very important area of pest management.

P1.14
The use of ISSR markers for assessing genetic stability of microcuttings in cornelian cherry (*Cornus mas* L.) 'Kotula'

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Micropropagation is one of the vegetative propagation methods gaining popularity. It is being used to obtain plants which are difficult to propagate by conventional methods like some woody plants. The produced plants should be identical to stock material but specific conditions during *in vitro* culture (wounding, disturbed nutrient balance, too high light intensity or improper growth regulator concentrations) may result in somaclonal variability. To assess the quality of the obtained plants at individual stages or at the end of the entire process, molecular markers based on the PCR reaction (Polymerase Chain Reaction) are used. Assessment of the quality of the obtained material is important especially for new varieties and orchard plants, the fruits of which are then eaten. One of the most valuable, though not so common, shrubs is dogwood. There are still few fruit plantations of this shrub, although its fruits are a valuable source of many vitamins. To evaluate genetic changes in microcuttings of cornelian cherry 'Kotula' PCR analyses were done with 20 ISSR (Inter Simple Sequence Repeat) markers. Microshoots were tested during multiplication which was carried out on Woody Plant Medium (WPM) supplemented with cytokinins: 6-benzyladenine (BA), meta-Topolin (mT) or thidiazuron (TDZ), each in concentrations: 0.5, 1.0, 2.0 mg·L^{-1}. The control material was taken from shoots cultured on the medium without growth regulators as well as from young shoots of the stock plant. ISSR markers allowed to find genetic differences between the stock plant and plants cultured on the medium enriched with cytokinins. Application of BA and TDZ resulted in a greater variability that that produced by mT. The highest polymorphism was found between the mother plant and plants cultured in presence of BA or TZD in the highest concentration (2.0 mg·L^{-1}).

P1.15
Status of microelements in leek on the Zagreb market

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Leek (*Allium ampeloprasum* var. *porrum*) is a biannual plant belonging to the Amaryllidaceae family. Leek is important vegetable crop, present in the market due to its nutritive and health benefits. Althoguh plants contain lower amount of macroelements compare to macroelements, microelements (such as iron, manganese, zinc and copper) are essential and equally relevant for plant nutrition as macroelements. Therefore, the deficiency of microelements has a significant negative impact on development and growth of the plant. Microelements in plants have significant and complex functions, most of which are connected to enzymatic reactions due to their ability to accept and release electrons. Proper diet is a precondition for everyday functioning of an organism. As for plants, microelements are equally essential for growth and development of human organism too, which are intaken by food consumption. When purchasing fruits and vegetables, the average consumer is not informed about the content of minerals found in the product they choose to consume. Therefore, the aim of this research paper was to determine the content of microelements of leek on the market. Sampling was conducted across nine purchase point in the city of Zagreb, including three markets, three retail chains and three eco produce shops. Samples were first dried, then homogenized which was followed by digestion in the microwave oven with HNO_3 and $HClO_4$. Microelements (Fe, Mn, Zn, Cu) were determined by atomic absorption spectrometry. Dry matter in leek ranged from 8.38 to 9.97%. The determined leek microelements content in dry matter (mg/kg DW) ranged as follows 76.2-153.1 Fe, 12.9-16.2 Mn, 18.5-26.2 Zn and 5.4-7.1 Cu, while in fresh matter (mg/100 g of fresh matter) ranged as follows: 0.91-1.71 Fe, 0.14-0.20 Mn, 0,21-0,30 Zn and 0,06-0,08 Cu. Generaly, the highest microelements content was determined in the leek sampled in retail chains. Comparing the recommended daily intake for humans with determined values of microelements, leek sampled in this research could satisfy 6.5-12.2% Fe, 7.0-10.0% Mn, 2.1-3.0% Zn and 6.0-8.0% Cu of daily intake.

P1.16
Geometric morphometry as a modern tool in medfly morphological variability assessment

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Compared to other fruit fly species the Mediterranean fruit fly or medfly, *Ceratitis capitata* (Wiedemann) is the most important fruit fly due to its ability to survive adverse and often unfavorable conditions. It is highly polyphagous since it inhabits over 200 plants species. Medfly is quarantine pest in Croatia (A2 list). It feeds on soft and juicy fruits such as mandarin and other citrus fruits, peach, apricot, pear, apple, etc. Damage caused by this pest is severe. Tissue around oviposition injection spot changes color, spot expands over few days and tissue beneath begins to rot causing a dent on the surface. Such fruit is completely unusable and has no market value. Damages are highest in summer and autumn. Agroecological factors such as soil structure, soil pH, weather conditions and suppression measures contribute to morphological variability of medfly. Morphological variation can affect species ability to spread and adjust to new areas. Geometric morphometric procedures are valuable tools for evaluating levels of phenotypic changes influenced by genetic changes. Such procedures were used in this survey in order to estimate influence of biotic (suppression and cultivation measures) and abiotic factors (weather conditions, soil) on medfly's wing size and shape. Based on different phenotypes we investigated the impact of change in medfly wings on its ability to expand into new areas. Morphology of medfly's wings has been analyzed by standard geometric morphometric procedure based on location of 14 markers placed on insect's wing veins. This innovative and effective but yet simple and cheap method establishes differences in wings shapes and sizes allowing us to use those differences as biomarkers of inter and intra-population variation. Implication of this

experiment suggests that geometric morphometric procedures can be used for population research with contribution to research of biological adaptation of medfly.

P1.17
Insecticidal effect of cinnamon essential oil in control of storage pests - *Tribolium confusum* Du Val. and *Oryzaephilus surinamensis* L.

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Biological plant protection products are becoming more and more important since the use of pesticides should be kept to a minimum due to their disadvantages, such as harming non-target organisms, persistence in the environment, residues in agricultural products, adverse ecotoxicological effects, and many others. Reducing or omitting the use of pesticides requires alternative possibilities in pests control. The aim of this study was researching the effect of cinnamon (*Cinnamomum ceylonicum*) essential oil on two species of storage pests, namely *Tribolium confusum* (confused flour beetle) and *Oryzaephilus surinamensis* (saw-toothed grain beetle). These pests represent an important problem in various warehouses, stocks, storehouses, silos, and other places for the storage of agricultural products and raw materials, where their nutrition and lifestyle reduce or completely destroy the quality of products. In this study the contact, the contact – digestive and the repellent effects of cinnamon essential oil on *T. confusum* and *O. surinamensis* were evaluated. Essential oil was applied at three concentrations (0.5%, 1%, and 2%), while for the control treatment alcohol and water were used. The experiment was performed in four replications with 10 insects in each, at a temperature of 25±1°C and 45–70% RH. The effect of oil was determined after 24, 48 and 72h. The repellent activity was assessed by using a Y-tube olfactometer with two concentrations (1% and 2%). Cinnamon essential oil showed great insecticidal effect in all tests performed. In the contact test for *Tribolium confusum*, essential oil of cinnamon caused mortality of 100% just after 24h in the concentration of 1% and 2%. The mortality caused by the concentration of 0.5% was also very high. After 24h mortality was 70%, and after 72h increased to 90%. In the same test for *O. surinamensis*, the mortality of 100% was also achieved in the concentration of 1% and 2% after just 24h. After 72h, mortality for the concentration of 0.5% was 75%. The contact-digestive test for T. *confusum* showed a slightly lower effect. The highest mortality was achieved after 72h in the concentration of 2%, while in the concentration of 0.5%, there was no effect in the contact-digestive test because all insects survived. In the same test for *O. surinamensis* the mortality of 100% was achieved after 72h in the concentration of 2%. Obtained results showed that the essential oil of cinnamon has great potential to be used in biological protection since it showed great results after just 24h.

Poster session 2: Sustainable food systems and quality

P2.1
Digestive pathologies caused by e.coli bacteria in dairy products

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Introductions. In humans and animals the microbiota is formed by microorganisms that populate the skin, cavities, digestive and respiratory tract, vagina, making populations with a very high density of Lactobacillus, Bacteriodes, Candida, Streptococcus, Escherichia. In the large intestine, the microbiota achieves high densities, 99% of the component bacteria being anaerobic. Anaerobic conditions are created by Escherichia coli and coliform germs that are optionally anaerobic.Aim. The purpose of the research was to identify the E. coli bacterium in dairy products to determine the origin of the diarrheal syndromes that affect the population through the consumption of dairy products.Results. The researches were carried out in Brașov country, in a dairy factory having an automated production and a dairy factory in which it intervenes manually in the technological process. Samples were taken in sterile vials and sown immediately after sampling on specific culture media and incubated at 37 degrees Celsius 24 hours, and after that reading the plates, counting the increased colonies and obtaining the statistical results which showed that in the factory with manual production we have a more significant growth of E.coli bacteria in dairy products. Fecal samples were also taken from the patients who came with diarrheal syndromes in the laboratory who had consumed dairy products and obtained positive results for E.coli bacteria. Conclusion. The cases of digestive infections analyzed in the laboratory came the majority from dairy products, and from the research conducted in two dairy factories we found that the cheese is contaminated after processing. References 1. Diliello, L.R.,1982. Methods in Food and Dairy Microbiology. AVI Publishing Co. Inc. Westport Connt. USA; 2. Cimolai N, Carter JE, Morrison BJ, Anderson JD. Risk factors for the progression of *Escherichia coli* O157:H7 enteritis to hemolytic-uremic syndrome. J Pediatr. 1990;

P2.2
Consumers' perception and fruit quality of some *Asimina triloba* (L.) DUNAL genotypes

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The objectives of this study are to present some data regarding some fruit's quality parameters and the customers' perception on few pawpaw hybrid genotypes in different ripening stages. Asimina triloba hybrids were cultivated in the experimental field established at the Faculty of Horticulture, within the University of Agronomic Sciences and Veterinary Medicine of Bucharest, in an organic orchard and all the determinations and analyses were made at the Research Center for the Study of Food Quality and Agricultural Products laboratories. The pawpaw fruits were harvested starting with the end of August – early September and ended up at mid-October. After harvest, the fruits were preserved in cold storage, at 1-2°C and 90-95% relative humidity. Fruits quality analyses were made in two different ripening stages: at harvest and after three weeks cold storage. Different fruit characteristics were measured and evaluated: fruit size and weight, soluble solids (SSC), glucose and fructose content, pulp color etc. The results showed important differences between the two ripening stages of pawpaw fruits. The sensorial analyses were organized with different age, gender and origin consumers, chosen to taste fresh fruit or three weeks cold stored pawpaw fruits. In the tasting questionnaire costumers evaluated, by using 1 to 5 grades, fruits size, shape, pulp color, taste and flavor. The obtained results showed that the fresh harvested fruits were easily accepted by the all consumers, while the overripen fruits were appreciated only by some of them. During cold storage the taste of the pawpaw fruit changes. While fresh picked fruits have an exotic taste similar to mango, pineapple and banana, during storage, the taste changes into caramel or even coffee-like flavour. In addition to the exotic taste and aroma, Asimina fruits are highly valued for their high content of vitamin A and C, mineral elements, especially Ca, Fe, Mg, Mn and amino acids. All these inner properties of Asimina fruits have been highly appreciated by consumers.
P2.3

Sensory evaluation of some fresh jujube fruits <and> jujube processed products

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Jujube (*Ziziphus jujuba* Mill.) is the most important species of *Rhamnaceae* family and is one of the oldest cultivated fruit trees in the world. Even if it was introduced in Dobrogea region, close to the Black Sea, some 2,000 years ago by the Greek and Roman colonists, jujube plants and fruits are nearly unknown, as it happens in other countries from the Mediterranean basin. The first cultivated varieties, more than 20 genotypes, from Shanxi Province, China were introduced after 1997 at the Didactic Experimental Field, Faculty of Horticulture in București within a common research project. The aim of this paper is to present the sensory evaluation of some fresh jujube fruits cultivars and customers' perception on some innovative products obtained from jujube. The results were obtained during the international workshop "Prospective of Chinese jujube (*Ziziphus jujuba* Mill.) cultivation in Romania" organized in 2nd of October 2020. Among the most common jujube cultivated in Romania, only the ones that arrived at the ripening stage: Jun Zao, Hu Ping Zao, Hu Ping AA and Early Hu Ping Zao, were tasted. The fruit size and shape, fruit colour, firmness and juiciness, taste and flavour were noticed with grades from 1 to 5, five being the highest value. The jujube tested products were: dehydrated jujube (simple, with walnuts or almonds), jujube liqueur (with plums and honey, with plums and rose petals, with honey, with rose petals), jujube tea, jujube compote and jujube tart. The consumers' panel for sensory evaluation was represented by farmers, researchers, teachers, specialists and ordinary people. The results showed that, the perception varied with the age, gender and origin, fresh jujube fruits and processed jujube products, being positively appreciated by most of the participants.

P2.4
Response of corn hybrids to fertilizers and planting density

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One of the most important practices for achieving higher corn yield is to make appropriate fertilization management and the spatial arrangement of plants. The objective of this study was to investigate the percent of abnormal ears (PAE), yield, and AEN (Agronomic Nitrogen Use Efficiency) of different corn hybrids in response to different fertilization and planting densities. The experimental design was a split-split-plot, where the main plots represent fertilizers (A), subplots represent hybrids (B), and sub-sub plots represent planting densities (C). Factor (A) included next treatments: Ø (control), N_2 (nitrogen), P_2 (phosphorus), K_2 (potassium), N_2P_2, N_2K_2, P_2K_2, $N_1P_1K_1$, $N_1P_2K_1$, $N_1P_2K_2$, $N_2P_1K_1$, $N_2P_2K_1$, $N_2P_2K_2$, $N_2P_3K_1$, $N_2P_3K_3$, $N_3P_1K_1$, $N_3P_2K_1$, $N_3P_2K_2$, $N_3P_3K_2$, $N_3P_3K_3$, where 1=50 kg/ha, 2=100 kg/ha and 3= 150 kg ha^{-1} of active matter. Factor (B) included hybrids: NS 3023 and NS 6140 (newer generation hybrids), NS 444 and NS 640 (older generation hybrids). Factor (C) included two planting densities: 57.971 plants ha^{-1} (LD) and 63.492 plants ha^{-1} (HD). The results showed that in older hybrids, the percent of abnormal corn ears was higher by 88%, on average, with the greater differences observed in hybrids with longer vegetation. For all hybrids, the higher percent of abnormal ears, by 21% on average, could be seen in HD. In fertilizer variants where N and P were omitted, PAE was highest, but also in variants where excessive use of NPK was used. Despite greater PAE, the average grain yield obtained with HD was statistically higher by 17.06% in comparison to the yield on LD. The greatest response in yield could be seen on $N_3P_1K_1$ fertilizer variant, where the highest yield difference of 18.36% in favor of HD was seen. Adding of 50 kg ha^{-1} of P and K elements ($N_3P_2K_2$ fertilizer variant), resulted in a yield decrease by 4.3%, while an additional 50 kg ha^{-1} of these elements ($N_3P_3K_3$ fertilizer variant) decreased yield by 5.6% for all densities and hybrids. The highest response in AEN for both densities was with 50 kg N ha^{-1}, where LD showed better AEN, but only with the lowest N dose. Furthermore, the AEN was higher by 6% in HD, and was by 25% lower in older hybrids, on average. All of the expected results were confirmed, except that early maturing hybrid NS 3022 showed yield decrease with HD, which means that interaction between corn yield and densities need to be further examined because the response between them can be positive, negative, or neutral.

P2.5
Brewers spent grain as functional ingredient for developing new food products

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In recent years many studies have shown that brewers spent grain (BSG), the major by-product of the brewing industry, is no longer regarded as waste but rather as a rich source of bioactive compounds, which remain unexploited in the brewing processes. Considering the increasing interest in finding new sources of functional ingredients, the dried brewers spent grain flour resulted from five different types of beer were evaluated for their potential to improve the nutritional value and aroma profile of a new food product. The fresh BSG samples, supplied by a brewery located in Cluj-Napoca, were oven-dried (60 ^{0}C/24 h), milled and kept protected from light and humidity. Five prototypes of biscuits were developed and analyzed in order to assess the contribution of BSG flours addition to the nutritional value, volatile aroma profile and consumers acceptability. The volatile fingerprint of each BSG samples and those of developed biscuits were determined using the ITEX/GC-MS technique and the proximate composition (proteins, fibers, lipids, and minerals) was performed by near infrared spectroscopy. The hedonic test was also conducted in order to receive a relevant feedback from potential consumers. A statistical analysis was applied in order to determine the significant differences between the values, considering the control sample (without BSG addition) as reference. According to the obtained results, the BSG samples contain appreciable amounts of bioactive compounds (16-18% proteins, 47-49% fiber, 5.5-6.6% lipids, and 3.2-3.5% minerals). Regarding the developed products, the substitution of wheat flour with 10-15% BSG has significantly improved the nutritional value and sensorial properties. The volatile profiles of BSG samples were qualitatively similar, the minor differences being influenced by the mashing parameters and the malt type specific to each assortment of beer. All the biscuits prototypes were characterized by significant levels of aldehydes (the representative ones being 3-methylbutanal, 2-methyl-propanal, 2-methyl-butanal and hexanal) these compounds being responsible for the malty, coffee, caramel and almond-like aroma. Moreover, compared with the control sample, the overall acceptability performed by hedonic test, revealed superior organoleptic attributes for all the biscuits enriched with BSG due to the flavor attributes imparted by the characteristic volatile compounds. The obtained results regarding the BSG composition and its influence on the tested prototypes emphasize the great opportunity to reuse this by-product in developing innovative added-value food products. Moreover, the reintegration of brewers spent grain by product in the food chain can be considered a significant step towards a sustainable circular bioeconomy. 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.

P2.6
Antioxidant activity and mineral composition of selected kind of small berry fruits

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Small berries are consumed due to their attractive colour, special taste and are considered as one of the richest sources of bioactive compounds. The aim of the present study was to determine antioxidant activity (ABTS method), total polyphenol (using Folin-Ciocalteu reagent), flavonoid (aluminium chloride method), phenolic acid content (using Arnov´s reagent) and chemical composition (AAS instrument) of cranberries (*Vaccinium vitis-idaea* L.) variety Sanna and Linea from local Slovak producer. Antioxidant activity ranged from 69.41 to 83.73 mg TEAC per g of dry matter (TEAC - Trolox equivalent antioxidant capacity). Total polyphenol content ranged from 20.46 to 26.56 GAE per g of dry matter (GAE - gallic acid equivalent); total flavonoid content from 2.06 to 2.67 QE per g of dry matter (QE - quercetin equivalent) and total phenolic acid content from 15.65 to 18.45 CAE per g of dry matter (CAE - caffeic acid equivalent). The higher amount of antioxidant activity as well as phenolics was observed in variety Linea. The same tendency was observed among mineral compounds - in variety Linea was determined higher amount (mg/kg) of iron (26.10), manganese (151.80), zinc (7.50), copper (2.50), nickel (2.10) and cobalt (0.30) with compare to variety Sanna (Fe - 18.30; Mn - 99.80; Zn - 6.80; Cu - 1.40; Ni - 1.20 and Co - 0.20). The amount of cadmium, lead

and mercury was not detected in observed samples, so our results reveal that the cranberries do not represent in this study a potential health risk regarding the content of toxic elements. The consumption of small berries as a part of food mode of consumers due to health benefits is recommended.

P2.7
Tillage, farmyard manure and gypsum effects on soil physical properties and yield in organic crop production in Mediterranean Croatia

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Mediterranean Croatia has a huge potential for organic agriculture, due to climate, unpolluted soils, and greater economic value of final products. However, soil productivity is often endangered in coastal regions by extensive soil salinity. Increased salt concentration accelerates the soil degradation process (slaking, swelling, dispersion of clay) and decreases soil water permeability and yields. Thus, the adoption of an appropriate agrotechnical system that is affordable and follows principles of organic agriculture for such soils is a basic need for sustainable organic crop production. In this study, in split-plot experimental design, the impact of three selected treatments was followed: control, G_6+OM (6 t gypsum + 40 t farmyard manure per hectare) and G_6S_2 (6 t gypsum + 2 t sulphur per hectare). The second factor consists of two tillage management: disc-harrow - DH and disc-harrow with ripping - DH+RIP. Soil physical properties and crop yields in saline-sodic soils of Raša River Valley, Istria (45°3' N; 14°2' E) were determined in two seasons from 2015 to 2017. In the season 2015/2016, the crop was spring oat (*Avena sativa* L.) and in 2016/2017 rye (*Secale cereale* L.). In the season 2015/16, tillage had a significant effect on water holding capacity at 15-30 cm, by DH+RIP (44.06 %) being greater then DH (43.57 %). Bulk density significantly increase with depth at both tillage treatments (DH+RIP: 1.31 g cm^{-3}, 0-15 cm; 1.48 g cm^{-3}, 15-30 cm; DH: 1.38 g cm^{-3}, 0-15 cm; 1.52 g cm^{-3}). DH+RIP (45.43 %; 39.09 %) had significantly higher total soil porosity on all depths in addition to DH (41.38 %; 38.11 %). Soil air-filled capacity was 14 % and 12% higher (p > 0.05) in DH+RIP than in DH treatment at 0-15 cm and 15-30 cm depths, respectively. Tillage show modifications on crop yields. DH+RIP treatments showed 15 % higher (p > 0.05) yields compared to DH treatments. Between amendments treatment, in season 2015/2016 G_6+OM treatment record 29 % higher yields of oat, while G_6S_2 treatment recorded 18 % lower compared to control. In 2016/2017, soil water holding capacity was significantly different between DH+RIP (48.54 %; 42.68 %) and DH (45.25 %; 41.58 %) at 0-15 and 15-30 cm depths. At 0-15 cm depth soil water content was higher in DH+RIP (46.25 %) than in DH (42.85 %) (p < 0.05). At both depths, DH+RIP treatment recorded significantly lower compaction and higher total porosity compared to DH. Air-filled capacity was 20 % higher in DH+RIP treatment than in DH treatment. Yields of rye were affected (p < 0.05) by tillage and amendments. G_6+OM recorded 25 % higher yield compared to control but didn't differ significantly. Unfortunately, the results cannot provide conclusive answers to finding a sustainable system for the specified region. The experiment should be continued by monitoring additional physical soil properties (aggregate stability, soil structure, and hydraulic properties) in order to find safer conclusions and recommendation for sustainable agro-system at saline-sodic soils.

P2.8
Effect of fertilization on yield and yield components of dried spicy pepper (*Capsicum annuum* L.)

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Optimized fertilization with organic and mineral fertilizers is the key for improving spicy pepper (*Capsicum annuum* L.) production. However, the informations about the relationship between fertilizers and spicy pepper are still limited. This work aimed to evaluate the effect of different rates and combinations of composted beef manure (CBM) and mineral fertilizers on the yield and yield components of dried spicy pepper. The field trial was conducted at the experimental field of Agricultural Expert Service Sombor, Serbia. The experiment was set up in a completely randomized design (CRD) with three replications per treatment. The fertilizer treatments examined were: T_1: Unfertilized control; T_2: CBM at 34 t ha^{-1}; T_3: CBM at 42 t ha^{-1}; T_4: CBM at 34 t ha^{-1} + N at 85; T_5: CBM at 42 t ha^{-1} + N at 105; T_6: NPK at 140-60-125; T_7: NPK at 105-84-175; T_8: NPK at 170-60-125; T_9: NPK at 210-84-175. The study showed that combined use of composted beef manure with mineral fertilizer (T_5) gave the significantly higher number of first class fruit (122.47 m^{-2}) compared to the lowest results which was recorded in the T_1 (85.95 m^{-2}). In treatment with only mineral fertilizers (T_6) the highest number of second class fruit was noted (9.42 m^{-2}), while the lowest number of second class fruit was recorded in the T_1 (6.04 m^{-2}). The highest weight of dried first class fruit was obtained at the T_5 (320.63 g m^{-2}) and the lowest weight dried first class fruit was reported by the T_1 (231.34 g m^{-2}), significantly increased by 27.85%. Regarding to the weight of dried second class fruit, the highest value was found at the T_4 (24.05 g m^{-2}), while lowest weight of dried second class fruit was found at the T_1 (14.53 g m^{-2}). This study showed that producers could apply combination of composted beef manure and mineral fertilizer, because the highest yield of dried spicy pepper was obtained at the T_5 (3.36 t ha^{-1}). Besides, this study will be helpful to develop new fertilization strategies to enhance spicy pepper production in the world, with high efficiency and minimum loss.

P2.9
Degradation of trifloxystrobin in apples before storage

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The storage of fresh apple fruits requires the application of fungicides before harvest, for the protection of causes rotting. In the controlled conditions in cold storage, fungicide residues may be stable for extended periods. For the control of the apple rot causing agent, a plant protection product based on trifloxystrobin (500 a.i./kg) was applied at the rate of 150 g/ha, with the consumption of 1000 l of water. The trial was set up at the locality Titel (Republic of Serbia), according to EPPO (2014) PP 1/018(3) method, 14 days before harvest. Apple fruit samples were collected one hour after application, and every second day for two weeks. Samples (around 1 kg) were transferred to the laboratory and frozen to −19 °C, to avoid their decay during storage.Trifloxystrobin residues were analyzed using high-performance liquid chromatography (HPLC/DAD), with a C18 column, using mixtures of acetonitrile and acidified water as the mobile phase. Trifloxystrobin was detected and quantified at 230 nm. For the extraction of trifloxystrobin, QuEChERS based method was applied. To ensure the quality of analytical results, the analytical method for the determination of trifloxystrobin residues in apple samples was validated. Obtained result for linearity (R2=0.999), recovery (99.23%), precision (RSD 0.23%) and limit of quantification (0.02 mg/kg), completely fulfilled SANTE/12682/2019 criteria. The initial deposit of trifloxystrobin in apple fruits (0.33 mg/kg) was below the MRL (0.7 mg/kg). In the samples collected two and four days after the application, residues were 0.31 mg/kg and 0.22 mg/kg respectively. At the end of the pre-harvest interval of 14 days , the amount of the trifloxystrobin residues was 0.10 mg/kg. Based on these results, the calculated half-life of trifloxystrobin in apple samples was 4.33 days.

Poster session 3: Environmental safety and climate change

P3.1
Differential responses of soil carbon dioxide emissions to fertilization during soybean vegetation

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Carbon dioxide (CO_2) emissions from terrestrial ecosystems represent one of the most important contributors to climate change. It is considered that most of the carbon released to the atmosphere is originated through agricultural activities that mainly increased since the industrial revolution where irresponsible land management often leads to soil carbon loss and increased carbon dioxide emissions to the atmosphere. Likewise, agricultural management practices that include changing the soil environment affect soil CO_2 flux. The objective of this study was to determine the influence of different fertilization in soybean agro ecosystem on CO_2 respiration. The field experiment with four different fertilization treatments was set up in central part of Croatia (N 45° 33' 21.42", E 16° 31' 44.62") on deep, distric pseudogley (Stagnosol). It contains four different fertilization treatments as follows: (I) control treatment – no fertilization, (II) organic fertilization – 40 t ha^{-1} of solid farmyard mixed manure + P + K, (III) mineral fertilization – 300 kg ha^{-1} N + P + K and (IV) black fallow – no vegetation. The cover crop at the experimental field in the investigated year (2018) was soybean (*Glycine max* L.– Tena variety) which was sown on 27th April 2018 and harvested on 26th September 2018. The experimental plot is characterized by continental climate. In the studied year (2018) mean amount of precipitation was 824.5 mm with mean temperature of 12.7 °C. The measurements of soil CO_2 concentrations and soil properties were conducted eight times during the vegetation year (January, March, April, May, June, July, August and September) in three repetitions on each treatment. The soil CO_2 concentrations were measured by a closed static chamber method with incubation time of 30 minutes. After 30 minutes, the soil CO_2 concentrations were measured with portable infrared CO_2 detector (GasAlerMicro5 IR, 2011). The soil carbon dioxide flux was expressed as kg C-CO_2 per ha per day. At the beginning and the end of each measurement, air temperature and relative air humidity were measured with Testo 610 (2011) and air pressure with Testo 511 (2011). Soil properties (temperature and moisture) were measured with IMKO HD2 – probe Trime, Pico64, 2011 at 10 cm depth in the vicinity of the chambers in three replications. Depending on fertilization treatment, mean annual C-CO_2 flux ranged from 7.7 kg ha^{-1} day^{-1} on black fallow to 16.7 kg ha^{-1} day^{-1} on treatment with mineral fertilization and were significantly different (SAS 9.1 p<0.05). Thus, through biological activity stimulated by N fertilization, CO_2 flux consequently increases. The highest soil temperature was recorded in May (31.4 °C) while the highest soil moisture was recorded in January (30.0 %). Increased knowledge about the impacts of the different land uses and soil management on soil GHG emissions can potentially be used in the creation of more sustainable agricultural practices. **Keywords:** soil C-CO_2 flux, fertilization, soybean

P3.2
The stem wood structure of Norway spruce and Scots pine witches' brooms

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Many tree species produce a proliferation of twigs called witches' broom which can be caused by several different factors e.g. infection of fungi, phytoplasmas, dwarf mistletoe or sometimes by a genetic mutation. Most of the research on witches' broom focuses on learning their genotype, the etiology of the disease, and the economic losses. There are few studies focusing on the stem wood anatomy of witches' broom of forest trees. The aim of this study was to investigate the tree rings geometry and anatomical structure of the stem wood of witches' broom of Norway spruce (*Picea abies*) and Scots pine (*Pinus sylvestris*). The present work was performed on the withes' broom specimens collected from adult trees of the two species grown in the forest stands in Poland. The geometry of the successive tree-rings boundaries was studied on the stem cross-sections cut at various distances from stem base of the witches' broom. Photographs of the tree-rings at the consecutive cross-sections stem discs were analyzed using the ImageJ program. Anatomical studies were done on the transverse, radial and tangential sections of wood cut on microtome and observed under

optical microscope. The results of the studies showed that apical dominance in the stem of witches' broom turned to be disturbed. It was evident both from the analysis of geometry and in the anatomical observations, especially of spruce's wood. The geometry of tree-rings boundaries was changing along with the height of the witches' broom stem. These changes were less visible in the scots pine. In the anatomical structure of wood of both species, the disorders such as the presence of shortened, obliquely oriented and curved tracheids were found. Disturbances in the arrangement of tracheids in radial rows, or occurrence of numerous resin canals as well as micro-knots were also observed. Reaction wood was present in the analyzed microscopic preparations of both species. The present results indicate that modification of stem wood structure of the witches' brooms of Norway spruce and Scots pine, to some extent, may be similar to those described for the structure of wood formed after stem wounding.

P3.3
Social vulnerability to natural hazards in Namibia: A district-based analysis

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Southern Africa is one of the world's poorest and most vulnerable regions with severe barriers to its sustainable development. We strived to understand here the patterns and drivers of social vulnerability to natural hazards in Namibia, which is the most arid sub-Saharan country with large social inequalities. We used a total of 12 indicators that characterized social, economic and demographic settings of the 14 districts in the country. Further, we evaluated the countrywide pattern of most relevant natural hazards, including wildfires, floods and drought. We identified the main factors driving social vulnerability in the districts, and we evaluated how the socio-economic fitness of populations coincided with the distribution of high-hazard areas. We found that populations with the poorest socio-economic performance were mostly distributed in the country's northern districts, which are also exposed to the highest frequency and severity of natural hazards, particularly to floods and wildfires. This coincidence of highly sensitive populations with high exposure to hazards renders these populations particularly vulnerable. That the frequency of natural hazards increases with climate change, and implementation of programs enhancing the social resilience is insufficient, underscores the urgency of actions targeted at the priority areas identified herein. Our results provide spatially explicit information on population vulnerability to hazards and identify priority areas, which require increased attention in investment and development actions towards enhancing the resilience of local populations, as well as sustainable resource management planning. The findings of the study fill an important gap in our understanding of social vulnerability patterns in Namibia, with implications for the broader southern African region.

P3.4
Waste cooking oil analysis and its potential as a valuable source for biotechnological purposes

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Introduction: The population increase causes the generation of massive amounts of wastes from different sources. Both liquid and solid wastes are engendering economic and environmental issues when they are unconventionally disposed of. A typical example is given by the lipidic waste generated from the food sector like used cooking oil, which is a major source of environmental pollution affecting both flora and fauna from specific areas, but also it contaminates the drinking water resources when this is randomly discharged. Used/waste cooking oil represents a sort of residual biomass that can be recycled and valorized throughout biotechnological processes, and at the same time diminishing the environmental issues.

Aims: The present work aims to investigate the physicochemical properties of the used vegetable oils derived from the food processing in order to establish their potential as a carbon source for biotechnological processes.

Materials and methods: The experimental work consisted of used cooking oil analysis of different origins, in terms of fatty acids profile, rheology, pH, density, and color. Used cooking oil was obtained by heating the samples for 30 min at 180°C. The samples of used oils were analyzed in parallel with unprocessed vegetable oils. The tests were performed in triplicates.

Results: The results obtained within this experiment showed different physical and chemical profiles between processed and unprocessed vegetable oils. All the investigated oils modified their colour after 30 min of heating at 180°C.

Conclusion: Used/waste oils derived from the food sector present different physical and chemical characteristics from the unprocessed ones and these could represent a valuable source of carbon for different biotechnological purposes, for example, these might be integrated into fermentation processes as the main nutrient for lipophilic microorganisms.

P3.5
Reduction of environmental pollution using technological processes of strip tillage and direct sowing Reduction of environmental pollution using technological processes of strip tillage and direct sowing

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In now days the main requirement for agriculture is to produce high quality and widely available production that will satisfy growing global population needs of the food, feed and fuel, while at the same time will have low environmental impact. Agriculture impact for climate change and the development of sustainable agriculture is a major challenge with which is facing our world today. Agricultural activity is widely recognized as a significant source of environmental pollution, particularly related to greenhouse gas (GHG) emissions, water quality degradation, water depletion and biodiversity loss. In order to reduce GHG emissions, it is necessary to develop cleaner production technologies that will reduce the carbon footprint of agro-ecosystems. The integration and application of sustainable farming practices can reduce the use of inorganic fertilizers, increase the efficiency of the systems and reduce the carbon footprint and its direct impact for the environment. The aim of this work was to evaluate the impact of strip tillage and sowing technology operations for soil and environment, to determine energy costs, GHG emissions and economic efficiency in growing winter rape and compare with traditional tillage and direct sowing In Lithuania. Also we investigate and compare the impact of traditional tillage, belt and direct sowing technological operations on the physical-mechanical properties for the soil, study and compare the influence of traditional tillage, belt and direct sowing on the changes of CO_2 emissions from soil and agricultural machinery. The results for rape strongly depends from tillage technologies. The lowest damage for environment and highest production were achieved when farmers were using sustainable tillage. Using more environmentally friendly agricultural technologies could be strategic options to mitigate climate change in Lithuanian agriculture and exactly in crop production.

Poster session 4: Rural development (including landscape planning) and rural economies

P4.1
Representation of water-stable soil aggregates in arable and forest lands and their comparison

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Water in the landscape is a question of optimizing precipitation-runoff relationships and strengthening water retention in the landscape (Hillel, 2004). WSA is a rate of the extent to which soil aggregates resist falling apart when wetted and hit by rain drops and also it shows resistence of soil to compaction. This task requires a comprehensive approach, with the focus on soil protection as the main medium of the whole process (Pachepsky, 2003). The main objective of the study was to compare the distribution of water-stable soil aggregates in arable and forest lands of the same origin in the neighbour plots.

Together 20 samples of arable land and 20 samples of forest land were taken at the locality Praha-Suchdol, Housle. Individual samples were then separated by dry sieving and the individual fractions weighed. This was followed by the wet sieving method for the determination of water-stable soil aggregates (WSA), which was based on research by Kemper and Koch (1966). Innovated laboratory device (Klíč, 2017) was used for wet sieving. Using the wet sieving method it was possible to determine the amount of water-stable soil aggregates fractions in both soils. The method of dry sieving revealed that agricultural soils had a higher proportion of soil aggregates of larger fractions than forest soils. Subsequent wet sieving showed that the forest soil contained a much higher proportion of water-stable soil aggregates of larger fractions than in agricultural soil, where the smaller fractions prevailed. This verified and confirmed the theory regarding the representation of water-stable soil aggregates in comparison of arable and forest soils, which was previously the subject of several scientific articles (Plante and McGill, 2002; Kurakov and Kharin, 2012; Šimanský et. al., 2017), where authors found out comparable results.

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