410 ÉVE AZ OKTATÁS ÉS A TUDOMÁNY SZOLGÁLATÁBAN, 100 ÉVE SZEGED ÉS A RÉGIÓ FEJLŐDÉSÉÉRT.

20th WELLMANN INTERNATIONAL SCIENTIFIC CONFERENCE

BOOK OF ABSTRACTS

3rd April 2023

Hódmezővásárhely

University of Szeged Faculty of Agriculture Hódmezővásárhely (Hungary)

University of Life Sciences "King Mihai I" Timisoara (Romania)

The Hungarian Academy of Sciences Regional Committee in Szeged,

Committee on Agricultural Biotechnology of Hungarian Academy of Sciences,

The Foundation for Agricultural Modernization and Rural Development,

Scientific Committee, Agricultural and Biosystems Engineering of Hungarian Academy of Sciences

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Published by: University of Szeged Faculty of Agriculture Andrássy út 15.

6800 Hódmezővásárhely, Hungary

Responsible publisher:

Edit Mikó dean

ISBN 978-963-306-924-0

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Zsuzsanna Széles

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The internationally accepted framework of green lending is based on four pillars, which together ensure that the use of a given loan is consistent with the achievement of specific climate and environmental goals. The first step is to examine the use of the loan, i.e. to identify the purpose of the loan. A credit goal can be considered a green credit goal if it ensures the achievement of specific climate and environmental goals while meeting specific conditions. The evaluation and selection of projects practically means checking their compliance with given green loan target conditions, which can be considered a green rating. The classification is based on classification systems or taxonomies, which can often be linked to reporting obligations or supervisory and regulatory programs. After the qualification, in light of the nature of the financed loan goal and its readiness at the time of signing the contract, the bank regularly monitors the implementation and the fulfilment of the agreed conditions. This is supported by the reporting obligation related to the fulfilment of the client's green commitment, which also ensures the availability of the necessary information for the fulfilment of supervisory reports and disclosures.

In August 2021, the Hungarian National Bank is a green company and municipal capital requirement discount program expanded with measures supporting the greening of agriculture. The starting point of these measures was the definition of sustainable agriculture, as well as the creation of consistency with the renewed Common Agricultural Policy, domestic and EU Biodiversity Strategies. Sustainable agriculture: "The management and preservation of the natural resource base, as well as the direction of technological and institutional changes in such a way that the continuous satisfaction of humanity's needs is ensured for both present and future generations. It preserves and improves the condition of agricultural lands and water resources. It preserves and improves biological diversity, including genetic diversity, species richness and ecosystem diversity. It reduces material use, energy use and waste."

During the research, I used the database of the MNB. From 2021, new opportunities for greening have opened up for the agrarian sector as well.

ANIMAL WELFARE ASSESSMENT PROTOCOLS IN RUMINANTS

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In the world, animal welfare concern about the farms, where livestock is raised, increased with the concentration of farms. Various welfare assessment protocols have been developed to measure the welfare of farm animals and to identify areas for improvement. Because the measurements are based on certain standards, one of the most important of these protocols is The Welfare Quality® assessment protocols. The Welfare Quality® assessment protocols, that developed to assess the quality of animal welfare on farms or at the slaughter, have been developed for seven livestock species, which dairy cattle, beef cattle, veal calves, sows, fattening pigs, laying hens and broilers. In the Welfare Quality® assessment protocols, three periods are taken into account in the assessment of welfare. These; the growing period, the production period, the end of life of the animal, which includes transport and slaughter. There are three broad categories of indicators used to assess animal welfare. These; resource-based indicators, management-related indicators and animal-related indicators.

Animal welfare measurement and evaluation protocols generally based on regular observation and examination of animals. However, in the world, sheep-goat breeding is carried out intensively as extensive production. In this system, it is more difficult to observe and examine animals regularly. Therefore, sheep-goat welfare to establish and improve welfare standards based on scientific studies are carried out in different countries and for different breeding systems. Dairy goat welfare measurement and evaluation protocols in European Union countries (AWIN- Animal Welfare Indicators Project), Australian Animal Welfare Standards and Principles for Sheep, New Zealand Sheep - Goat Welfare Regulation and Canadian Sheep Care and Management Implementation Regulation are some of these. In 2011–2015, an EU-funded project on Animal Welfare Indicators (AWIN) developed on-farm welfare assessment protocols for sheep, goats, horses, donkeys and turkeys, possibly using animal-based indicators. The AWIN Welfare Assessment Protocol for Dairy Goats was developed for intensive dairy goat farms.

Today, many scientific studies are continuing on the measurement of welfare for livestock in different breeding systems (intensive, semi-intensive, extensive) and with different indicators.

EDIBLE INSECTS AS ALTERNATIVE PROTEIN SOURCES

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The demand for protein is growing worldwide, partly because of the growing population and partly because of the increasing need (for meat) in rapidly developing regions. This will be increasingly difficult to meet through conventional livestock production, so we are looking for more sustainable, economical and environmentally friendly alternative methods. The inclusion of high protein crops in animal feed and for human consumption, in addition to lab-grown meat or plant-based meat substitutes, is another way of ensuring nutrient replenishment through the use of insect-derived protein.

Insect production is gaining momentum, as its potential relies not only on food and feed, but also on the context of a circular economy. Insects have the potential to convert a wide range of organic by-products into feedstuffs, which then go back into the production cycle. Insects can provide high-quality protein and nutrients for humans and animals, comparable with that provided by meat and fish, depending on their species, diet and stage of life cycle. As a source of proteins, lipids, carbohydrates, vitamins and minerals, insects show a great potential as food source.

According to the history of entomophagy, the Chinese began eating insects more than 3,000 years ago and edible insects are for a long time part of the human diet in several countries. There are more than 2,000 recorded species of edible insects around the globe.

Insects are comparable to other foods of animal origin in terms of nutritional value. Moreover, insect farming has environmental and economic implications, since insects are easily maintainable, require fewer resources and have a smaller impact on the environment compared to common livestock farming.

Europeans have reservations about eating insects as it is not part of their culture and many consider it disgusting or a sign of poverty. Thus, consumer acceptance, particularly in European countries, is a barrier to the market introduction of insects as food sources. There are signs that consumer attitudes in some developed countries are changing, but cultural barriers remain in many others.

Scientists are looking for alternative solutions to improve processing, to isolate proteins and lipids from insects to be used as food ingredients and to increase the shelf-life of insect products, in order to increase consumer acceptance.

Insects are classified as “novel food” in the European Union, they need to undergo a strict authorization procedure, which includes a safety assessment in a case-by-case approach. Based on such a risk assessment the frozen, dried and powder form of four insects have already been authorized to be placed on the market in the EU.

AGRICULTURAL ECONOMICS AND INNOVATION IN AGRICULTURE

AGRO-PHOTOVOLTAICS: A SUSTAINABLE SYNERGY BETWEEN FOOD PRODUCTION AND RENEWABLE ENERGY GENERATION

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Agro-Photovoltaics (APV) is an innovative approach that combines the production of food crops with the generation of solar energy. APV has been shown to increase land productivity, particularly in dry and arid regions, where water efficiency is improved through the use of PV panels. In addition to improving water productivity, crops grown in APV systems also benefit from reduced solar radiation, resulting in better crop yields. APV implementation can also generate additional income through energy production, improving the profitability of agricultural operations, while also contributing to rural electrification as part of decentralized energy systems.

This paper provides an overview of the benefits of APV systems for sustainable food and energy production, drawing on research from various countries. We discuss the potential for APV to improve land productivity, enhance water efficiency, and provide additional income for farmers. We also highlight the importance of conducting further research to investigate the feasibility of APV implementation in Hungary.

Overall, APV offers a promising solution to promote sustainable food and energy production, while also supporting rural development. However, before its implementation in Hungary, further studies are needed to evaluate its potential in local agro-ecological conditions, assess its economic viability, and investigate the social and environmental impacts. These studies could provide a solid foundation for policy makers and investors to support the development of APV in Hungary.

COLOUR-MASKING OF DOMESTIC PAPRIKA (CAPSICUM ANNUUM L.) POWDER

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For testing of coloured food products, it is recommended to implement a testing environment based on standards, where colour differences between products do not affect the assessment of other sensory parameters (taste, flavour, texture) (ISO 11037:2011). In international practice, colour masking methods are used to achieve this, but all of them are subject to errors. In our study, we investigated 12 types of commercially available paprika powder. Therefore, as a first step spectral characteristics of the samples were characterised (Konica Minolta CR 400) in reflection mode in the light range visible to the human eye (380-780 nm). A monotonic ascending colour series was generated based on the L*,a*,b* values obtained from the samples, where the difference between the samples was almost similar (ΔE_{ab}=1.5-2.0). The spectra can be used to determine the range where masking can be effectively implemented. The vision of the sensory assessors (visual acuity, contrast sensitivity, colour vision) was tested (ISO 8586:2012) by assessors with normal vision under reproducible lighting conditions (ISO 11037:2011). Paprika samples were first arranged by the assessors in standard white (D65) illumination environment and then the same was done under different coloured light environments in a spectrally tunable light booth. The correct order characterises the masking effect of light environments. The results showed that all the samples of paprika differed from each other under the standard reference white illumination environment (Page test, Cabilio-Peng pairwise post hoc test). The most effective masking effect was obtained under the blue illumination environment.

ECONOMIC IMPACT OF SOYBEEN-FREE FEEDING ON LAYING HENS

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It is important to try to find alternative ways of feeding, to try to replace the feedstuff coming from overseas. This way, farmers can save money, and animal breeders can support their plant grower colleagues by buying domestic products. With this, we can also help the environment by not importing large amount of grains and reducing the ecological footprint. It was examined how soybean and soybean-free feeding affected the laying hens, in terms of productivity, death loss, dirty eggs rate and broken/waste egg rate. Our main goal was to examine the economic impact, of the above-mentioned ways of feeding. The investigation has been done in two separate farms, with the same technology used in the barns, and the same Lohmann Brown Classic laying hens, with a similar stock density. The research proved that soybean-free feeding has much better economic outcome, than the regular feeding with the use of soybeans. The imported soybeans (from America) were replaced by domestically purchased sunflower meal. With the use of sunflower, the farms' economic status got better, and the logistics were easier to handle. Millions of forints were saved, just by the feeding method. On top of this, the ecological footprint had been decreased, as the material of the feedstuff were bought domestically, and long transportation was not required. Added values, such as the statement of "GMO-free product" were created thanks to this soybean-free feeding method.

INNOVATION IN HUNGARIAN AQUACULTURE

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The combined Hungarian agriculture, forestry and -aquaculture national economic branch contributed 3.9% to the production of the GDP in 2021, and the gross production value of the aquaculture sector alone was 26.4 billion HUF. Within the livestock sector, the contribution of the aquaculture sector to the national gross product is constantly increasing, despite it generally being in outdated technical conditions.

On the other hand, before the regime change in Hungary, this sector produced one of the largest income values within agriculture in the field of international knowledge and technology transfer. As a result of environmental effects, the strengthening of regulations and their enforcement, as well as the Covid-19 epidemic, marine fish catches decreased by 3.8% in 2020 compared to the average of 2017-2019. In addition, the EU is a net importer of aquaculture products (68% of the aquaculture products consumed in the EU are not produced in the EU). The decline in marine fisheries offer a chance to increase the market share of the freshwater aquaculture sector. The recent increase in energy and feed raw material prices makes the situation even more complicated.

In the current economic environment, there is an increased need to respond to problems through innovation. The development of the Hungarian aquaculture sector has three objectives: i) traditional pond farming; ii) precision (intensive) fish production; iii) and modernization of fish processing are both priority and at the same time complex development areas.

We examined the main challenges of these areas and identified proposed solutions that, thanks to the recent innovation developments, can provide a solution to some of the sector's problems. It can be concluded that willingness and susceptibility to innovation are present in the sector. Excellent national and international developments have been made recently. It is a national economic task to support the actors of the innovation chain of the aquaculture sector in their renewal.

INVESTIGATING THE EFFECTS OF PEPTAIBOLS THROUGH STRUCTURE- ACTIVITY RELATIONSHIPS

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In terms of agriculture and biocontrol, the role of filamentous fungi from the genus *Trichoderma* has been increasing in the recent years. Among the secondary metabolic products of *Trichoderma* species, peptaibols are of particular importance, and due to their characteristic properties, peptaibols may potentially be used in agriculture in the future. Peptaibols exert inhibitory effects against various plant pathogenic Gram-positive bacteria as well as fungal plant pathogens. Based on previous experiments, peptaibols may have the potential to support plant growth and provide protection against plant pathogenic microorganisms. In addition to laboratory tests of the purified peptaibol extracts, we can deepen our knowledge about the effects of peptaibols through *in silico* studies, such as accelerated molecular dynamics (aMD) simulations.

In our experiments, the peptaibol production of 8 strains of *Trichoderma* species were determined, and purified peptaibol extracts were examined through laboratory tests and modern molecular modeling tools. The peptaibol extracts were tested against commonly known 11 Gram-positive and Gram-negative bacterial strains, as well as two plant pathogenic fungal species. The minimum inhibitory concentration (MIC, mg ml^{-1}) and effective concentration (EC, mg ml^{-1}) values of the purified peptaibol extracts were determined and the results were compared with the characteristic properties of the most produced peptaibol sequences simulated by aMD.

Correlations were studied through the investigation of structure-activity relationships (SARs) of peptaibols. By examining peptaibols from different aspects we can gain a wider insight into their bioactivity and promote their possible future application in crop protection and agriculture.

MAIN CHANGES IN FOOD TRADE IN EUROPE AND THE WORLD UNDER COVID-19 RESTRICTION

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Restriction during the 2020 COVID-19 pandemic has brought significant changes to all aspects of life, in food consumption and foreign trade. This raises questions about local and intercontinental food trade and transport. The aim of this paper is to describe the European and global changes, focusing on their background and causes. Its methods are to examine the foreign trade data of the main food products in the WITS database using a trend function and to investigate possible changes by calculating the Balassa index. The first results show that in absolute terms, the value of foreign trade has not decreased for most food products, but that there has been a decrease for almost all food products compared to the expected value of the trend function. When calculating the Balassa index, it is expected that the countries with the most competitive advantages have maintained their competitive advantage and the countries with competitive disadvantages have not been able to gain an advantage during this period. The main conclusions of this research are that COVID-19 has also had an impact on food supply. There is a need to maintain and support local markets and regional trade in the face of global food trade, as only they can remain stable during these crises and austerity.

THE IMPORTANCE OF COUPLED SUPPORT IN HUNAGRIAN LIVESTOCK PRODUCTION

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A new era of the Common Agricultural Policy (CAP) begins with the 2023 application period. The CAP will have to meet thematic objectives and overarching sectoral expectations, which will present new challenges for the sector.
In this context, a number of new measures and entitlements will be announced, but the system of coupled support will not change substantially. The role of coupled support is to help sectors in difficulty and to ensure that they can continue to function. In addition to the arable measures, 4 titles will support livestock farmers, with targeted aid for cattle and sheep farmers.

The study reviews the specificities of the sector, the legislative environment of coupled support, the main features of the measures and the main developments in the period under review.

Given the importance of this instrument for domestic farmers, the analysis concludes with an overview of the expected future impacts, results and consequences.

THE MAIN OBSTACLES TO GENERATIONAL RENEWAL IN AGRICULTURE

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Population growth is continuing, while land availability is decreasing, resources are limited, many more people have access to safe and nutritious food, and the climate significantly shaping the industry. In addition, the ageing agricultural population is a major concern in the European Union. In 2016, more than half of the farmers in Europe were over 55 years old, while young farmers under 40 years represented 10% of the total agricultural population. In Hungary, 35% of farmers were over 65 in 2020, while the share of farmers under 40 was only 10%. This paper aims to provide an overview of generational renewal in agriculture based on the international literature published in recent years using a systematic literature review. Research has identified several factors as barriers to agricultural generational change. Young people are less motivated to take over family farms. Farming does not offer them sufficient income and the working conditions are not ideal. Access to land is severely limited worldwide and the market bargaining power of the younger generation is low. Administrative burdens are also a barrier to the generational renewal of farms; however, only European researchers mentioned it. The effects of climate change also have the potential to discourage next generation farmers. Besides financial support, there are other policies that can help the new generation. Such as: supporting education, diversifying incomes, promoting modernisation, supporting organic farming, simplifying administration, supporting cooperation, and young farmers' associations. However, even successful support policies cannot stop the decline in the number of young farmers.

Short presentation

VALUE CHAIN ANALYSIS IN AQUACULTURE DEVELOPMENT

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The development of the aquaculture sector is a complex activity turning natural resources into safe, healthy and nutritious food to satisfy diverse consumer requirements. Many development projects focus on only one or a few elements of the whole aquaculture sector instead of applying a holistic approach to evaluate business activities and to explore how to provide the most value to customers while maintaining a good profit. The aquaculture sector is increasingly facing new challenges such as climate change, and resiliency, and the market is increasingly complex and competitive, so there is a need for the application of methods during efficient development programs such as the Value Chain Analysis (VCA). It is a useful approach to evaluate business processes and identify opportunities for innovation. Sector-wide value chain analysis involves the survey of the various stages of aquaculture production, from broodstock management all the way through the final purchase of fish and fish products by end-users. Value chain differs from the supply chain which is a conveyance procedure from producer to consumer, while value chain flows reverse from consumer to supplier. Value chain is also referred to as „demand chain" since consumers are the source of value. Value chain focuses on innovative product development and marketing.

CAN YOU TELL ME WHERE YOU SHOP? I'LL TELL YOU WHO YOU ARE!

CONSUMER ANALYSIS OF FARMERS' MARKETS USING A SYSTEMATIC LITERATURE REVIEW

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In recent decades, the number of visitors to farmers' markets has increased significantly. This growing popularity is not only noticeable in Hungary, but also in other countries around the world, and is confirmed by the steady increase in the number of studies on farmers' markets. Our study presents a systematic literature review using the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) procedure to collect, synthesize, and analyse empirical research on consumers of farmers' markets. In the present work, the authors set out to draw findings from previously published studies on consumers of farmers' markets in terms of socio-demographic, income, environmental, and health factors. As a result of a systematic literature review, the vast majority of farmers' market consumers have well-defined and describable characteristics (age, gender, income, place of residence, marital status, education, price sensitivity, etc.). The consumers of farmers' markets are typically middle-aged or older women, with higher education, higher average income, living in a couple or in a married couple, who are interested in health and who have access to tasty, quality products at farmers' markets, and are willing to pay a price premium for them.

DOES CONSUMER ETHNOCENTRISM EXIST IN THE HUNGARIAN ALCOHOLIC BEVERAGE MARKET?

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One of the most important issues of the international economy is consumer ethnocentrism, the tendency of customers' preference to their local products and brands over foreign ones. Consumer ethnocentrism plays a key role in developed countries and appears more in the purchase and choice of local food and beverages. The purpose of our study is to investigate the relationship between ethnocentrism and different socio-demographic characteristics. According to the literature, there is a need to test the impact of consumer ethnocentrism on different products, and research on national and GI (Geographical Indication) products is very limited. Thus, we analyse ethnocentrism among palinka consumers, which is one of the best-known national products in Hungary. The analysed sample contains the answers of 760 respondents. CETSCALE items were used to create consumer groups using the clustering method of latent profile analysis (LPA). Despite growing globalization and consumer openness to foreign products, there is a high level of ethnocentrism in the case palinka consumers. Four separable consumer groups were identified, which have different characteristics, and require different marketing strategies from the corporate side.

ECONOMIC ANALYSIS OF PRECISION CULTIVATION OF AUTUMN RAPESEED

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By utilizing precision plant cultivation systems, we can maximize resources and minimize wastage and loss. To make this well-functioning system possible, the continuous recording and accurate data collection of the production site is essential. All of this requires a change of attitude not only on the part of developers and machine manufacturers, but also on the part of farmers, so that the data can become readily available decision support information without external help. In our research, we aim to present the economic analysis of the production of autumn rapeseed with precision technology. We are investigating an agricultural company whose crop production can be considered a leader in the application of precision technologies on a national level. The idea that the more intense a crop production system is, the greater the benefit of using site-specific technology - is fully realized at the company under consideration. In our work, we present the elements of the precision technology used in rapeseed cultivation. Based on this, we calculate the costs and the income available with rapeseed cultivation. We determine results with and without subsidies, which can provide information on the actual income-generating capabilities. Among the performance indicators, we determine the unit cost, efficiency and profitability of rapeseed growing. Using a technological and economic approach to production, we highlight the possibilities of a more economical and profitable production.

FARMERS' MARKETS IN THE 21ST CENTURY – A BIBLIOMETRIC OUTLOOK

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Short food supply chains are considered a potential solution for sustainable food consumption in the 21st century. Traditionally, farmers' markets are the most commonly used sales channels among short chains in many countries. In the last decades, the literature on farmers' markets exponentially grew, together with their importance in the food supply chains in both developed and developing countries.

In our study, we provide a comprehensive overview of the related literature available in the Scopus and Web of Science databases (n=1,765), applying bibliometric technics (collaboration and thematic maps, co-citation network, bibliometric coupling, thematic evolution, trend topics, and historiogram).

The results clearly indicate the most important trends and also identify the main topics to be covered in the short and middle term. First, farmers' markets can be considered a food supply source of fresh and nutritious foods for average or vulnerable consumer groups (e.g., in Europe, or in the USA, respectively). Second, farmers' markets can contribute to the sustainability measures expected by strategic initiatives of the European Union. Third, food safety issues are still on the agenda, mostly in developing countries.

FARMERS' MARKETS ORGANIZED BY UNIVERSITIES

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One of the most popular types of short food supply chains is the farmers' market, which have become a frequently studied area of international studies since the 2000s. Many studies focus on farmers' market consumers, but only a few studies examine the farmer's market related habits of university students. Few examples exist in the USA; it is even typical that farmer's market is organized on university campuses. A questionnaire survey was conducted on Hungarian university students' food buying and farmers' market habits. University students' preferred factors when buying food are quality, price, and healthiness. We identified three clusters based on food purchasing habits, that producers can approach using different methods. 21% of the respondents buy regularly at the farmers' market. The main barrier for non-regular buyers is the distance from farmers' markets, which can be solved by organizing farmers' markets on university campuses. 95% of the students would be open to shopping at the farmer's market organized on the university campuses. Based on the practice developed in the USA, it would be worthwhile to assess the needs at specific universities as well.

PRODUCERS IN SHORT FOOD SUPPLY CHAINS AND THE ROLE OF LOCAL FARMERS' MARKETS IN SALES

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Recently, there has been a growing interest in local farmers' markets as the most significant areas of short food supply chains (SFSCs). The current study primarily focused on these market locations as the most important local food systems. In the course of our research, we conducted a questionnaire survey involving small producers operating in the county of Győr-Moson-Sopron and selling at local farmers' markets. The three locations of the surveys were the "Szigetköz Szatyor" farmers' markets, approximately 4,000 customers and 25 producers (food products) participated. The number of completed questionnaires was 24 from the producer side and 125 from the consumer side. Within the framework of this study, in relation to the circle of producers, the method of farming, the viability (sustainability) of the economy, the role of direct sales, the forms of sales and their frequency, and the distance of delivery were part of the analysis. More than half of the respondents indicated the conventional way of farming. According to the producers, the eco/bio cultivation method appears only to a limited extent. Contrary to our hypothesis, the proportion of those who gave the highest values to the question about the viability of the economy was outstanding. The respondents consider the role of direct sales to be particularly important. Examining the forms and frequency of sales, it can be stated that the farmers' market is one of the main location for sales on a weekly and occasional (monthly) basis. Regarding the delivery distance, almost half of the respondents deliver within a radius of 50 km, but they consider longer distances to be acceptable. Overall, based on the opinions of the surveyed producers, the role of farmers' markets is prominent within the SFSC sales methods, and this might be true for the future as well.

REVIEW OF DIAGNOSTIC SIGNS OF INVOLUTION PROBLEMS IN DAIRY COWS BY THE HELP OF CATUS DATABASE

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Post-partum reproduction anomalies (increased calving interval and semen doses, pregnancy loss, infertility culling rate) are mostly caused by involution problems. The aim of this study was to find diagnostic symptoms (signs) help in identifying animals having possible subclinical endometritis. As a logical first step, analyzing a database with several thousand transrectal post-partum palpation and ultrasonic findings of the genital tract and production data of dairy cows (CATUS) seemed reasonable. Healthy (H) cows and animals with clinical endometritis (CE) both are in this database. We thought that statistical analysis of large amount of H and CE animals' data should help in identifying signs or reasonable suspicion for recognizing cows with subclinical endometritis (SCE) in the future as well. During this work palpation and ultrasound data of healthy and CE cows were compared. Totally, data of 10683 cows were evaluated by chi-square test. These results show distinct differences in distribution of uterine size (volume) and ovarian phenomena in the two groups. As a sign of inappropriate involution large-sized uterus (32.9 % vs. 64.9 %) and uterine fluid content (6.1 % vs. 31.1 %) were significantly higher ($P<0.0001$) in CE group. Abnormal ovarian ovulatory phenomena (corpus luteum /CL/ with cavity: 8.0 % vs. 13.1 %; or cystic CL: 4.2 % vs. 27.4 %) also were detected in significantly higher numbers in animals with CE signs ($P<0.0001$). These results induce further examinations to compare them with SCE animals' data for identifying diagnostic signs which are typical for the examiners.

AGRICULTURAL PRODUCTION

CHALLENGES OF ESTABLISHING THE CIRCULAR OYSTER MUSHROOM PRODUCTION MODEL IN KENYA

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Pilze-Nagy Ltd., the largest oyster mushroom producer in Central Eastern Europe, has been applying circular model in industrial practice for years. The key is the biogas plant which secures the by-product valorisation to renewable energy and the closure of the nutrient loop by returning the digestate to the fields. Now, the company is tailoring this model in Kenya to answer the food security, climate change and demographic challenges. We follow a systematic, step-by-step method to map the local possibilities, understand the challenges and adapt our know-how. First we broke down the steps of the circle: feedstock assessment and substrate development, substrate preparation, oyster mushroom production technology scouting fitting local conditions, spent mushroom substrate valorisation, and oyster mushroom market study. To confirm interest, this supply chain analysis was complemented by stakeholders' survey. Results show that there are available local biomass feedstocks appropriate to grow oyster mushroom even if using the traditional low tech substrate preparation method. The key market for oyster mushroom is the urbanized and growing mid-class population of large cities, such as Nairobi. The climatic conditions of the surrounding of Nairobi (i.e. close to market) offer good conditions for mushroom growing as with minimal equipment and energy investment the near optimal environmental parameters can be set. The analyses of all steps indicate that there is potential to tailor circular oyster mushroom concept in Kenya, not just by biological, physical and climatic conditions but also considering market and economic burdens.

COMPARISON OF THE FLEECE PRODUCTION OF TWO EXTENSIVE FRENCH SHEEP GENOTYPES

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Sheep fleece became problematic Europe-wide for many reasons, including its very low price. From an animal welfare standpoint, the thick fleece may cause discomfort for the sheep as it can be a welcoming environment for parasites and may cause heat stress during hot summer days; therefore, annual shearing is necessary for most sheep genotypes. Physiologically, growing fleece and maintaining normal body temperature to decrease heat stress distract resources from producing valuable products such as meat. Thus, we aimed to compare the fleece production of two meat-type sheep genotypes from South-France, Berrichon du Cher (Berrichon) and Blanc du Massif Central (BMC), which have relatively little fleece production but thrive in the local Hungarian weather. Furthermore, we fill the gap by providing data on the fleece production of meat-type sheep in Hungary. A total of 180 sheep ewes were included in the data collection (N=99 Berrichon and N=81 BMC). Data was collected at the annual shearing by a digital scale measuring the weight of fleece originating from the back and shoulders. Student's t test determined the differences in fleece weight between genotypes. Significance was set at $P<0,05$. The average fleece production of BMC ewes was 1,66 kg, which was significantly ($P=0,0001$) less than that of Berrichon ewes (2,4 kg). Based on the results, further study is needed to study the performance of BMC ewes with little fleece and their lambs' in order to improve performance indices and increase profit.

DEVELOPMENT OF GROWING MEDIA FOR ORGANIC SEEDLING PRODUCTION FROM DOMESTIC RESOURCES

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For organic producers, the growing medium must meet both the ecological regulations and the biological needs of the seedlings. At the same time, it must be affordable and environmentally sustainable. In Hungary, the most common growing mediua are peat and coco coir. Peat is one of the hard-to-renew organic materials, and coco coir is a by-product of coconut farming, shipped to Europe from the Far East for horticultural use. The main goal of the experiment is to develop commercial, compost-based (green waste, spent mushroom compost and vermicompost) peat-free universal growing medium(s) that can be used in organic farming. This study aims to create a growing medium for seedling production consisting of local, sustainable materials that can also be used in organic farming to raise quality seedlings. The research also covers the effect of the growing medium on the development of plants throughout the entire growing season.

Since 2021, we have conducted five experiments on growing seedlings using different organic materials. In all experiments landrace tomato species have been used. Plant development was monitored for six weeks, wheregermination rate, seedling height the number of the true leaves and the plants' general condition were measured soil's moisture content. In the summer of 2022, the seedlings were planted out to a non-irrigated field in Vas County. The documentation process was based on these measurements during the vegetation period: Plant height, SPAD measurement, amount of fruits/weight in grams, and average yield per root. Our conclusion is that certain experimental mixtures are not ideal for seedling production. Mixtures with 100 % one component have not performed better and will be further tested in next year's trials.

EFFECT OF DIFFERENT NITROGEN FERTILIZER AND PLANT DENSITY ON YIELD OF FOUR HYBRIDS OF SWEET CORN (ZEA MAYS L. SACCHARATES)

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The experiment was carried out at the Látókép Plant Cultivation Research center of Debrecen University During season 2022. The experiment was conducted in a randomized complete block design with four replications of Sweet corn. To investigate the effect of nutrient reaction and plant density on yield of sweet corn used four hybrids of sweet corn. Based on the Results of plant density experiment it was concluded that the successful production of the examined hybrids is possible with lower plant density (60,000 plants per ha) Averaged over the examined sweet maize hybrids, a yield reduction of 1923 kg and 1407 kg was realised in the case of 70 000 and 80. 000 plants per ha respectively compared to the plant density of 60. 000 plants per ha (17 519 kg/ha). The performed N dose experiments in sweet maize showed the successfulness of applying 100 kg N/ha. Doses of 150 and 200 kg N/ha have unfavourable effect resulting in a yield reduction of 461 and 1405 kg/ha, respectively.

IDENTIFICATION OF *LR34* AND *YR17* RUST RESISITANCE GENES OF WHEAT USING MOLECULAR MARKERS

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In Hungary, leaf and yellow rusts are important foliar diseases. As new virulent races can appear, it is important for breeders to know of the genetic background of the resistances in their cultivars. In this study, 69 Hungarian wheat cultivars, registered from 2005 to 2022, were investigated using molecular markers to determine the frequency of an important leaf (*Lr34*) and yellow (*Yr17*) rust resistance genes. All cultivars, except 2, derived from two main Hungarian breeding programs – Szeged and Martonvásár, 28 and 39 cultivars, respectively. In all cultivars investigated the leaf rust resistance gene *Lr34* was found in 7 cultivars (10.1%), and the yellow rust resistant one *Yr17* was in 22 cultivars (31.8%). The two main Hungarian breeding programs differed in the exploitation of these two genes. Among the Szeged cultivars, *Lr34* was present at low frequency (7.1%) and in Martonvásár cultivars it occurred at a higher frequency (12.8%). However, the difference in the use of *Yr17* gene was much pronounced in Martonvásár cultivars (46.1%) than in Szeged ones (14.3%). Data may help breeders to incorporate effective rust resistance genes into new cultivars.

IMPACT OF DIFFERENT NUTRIENT SUPPLY LEVELS ON YIELD PARAMETERS OF ORGANIC KAPIA PEPPER IN PLASTIC TUNNEL

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The use of commercially available, easily applicable, pelleted manure for nutrient supply has become a common practice of Hungarian organic vegetable growing farms, although nutrient mineralization of these products is little known. In our research, the yield, and the parameters of kapia pepper under different level of nutrient supply and the speed of nutrient release of the applied products in the soil were investigated. The experiment was carried out in an unheated, 196 m² plastic tunnel on a certified organic farm. The soil was loam, pH_{KCl} is 7.4, with humus content 2.7%, low N and high P and K content. The 'Kapirex' pepper plants were planted in 40+80×25 cm spacing in May 2022. Three nutrient supply levels were set up with increasing nutrient content in 4 repetitions. According to the results, a basic nutrient supply (with 22 kg/ha N) with manure pellet on a soil with average humus content can achieve the average yield expected in organic farming, but lower quality can be expected. The intermediate technology (with 78 kg/ha N) with alfalfa pellets showed that it is worthwhile to choose alfalfa meal or other more rapidly revealing nitrogen sources instead of alfalfa pellets. The professional technology, with frequently repeated fertilisation (126 kg/ha N) resulted only 3.6% higher yield, but there was a noticeable effect in early ripening, in higher number and size of fruits, but above average infestations of thrips species and *Helicoverpa armigera*.

LET'S SAVE OUR NATIVE CHICKEN BREEDS WITH THE CAPON AS A CURIOUS PRODUCT!

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The task of gene preservation arose in the middle of the 20th century. Hungary was among the first to include the preservation of its native breeds in its national program. Nowadays, when hybrids dominate the production of animal products, the keeping of native animals, and thus the keeping of native chickens, is also in danger. In order to preserve our old varieties, it is necessary to find ways out that can save the given breeds. In the case of indigenous Hungarian chickens, there are many possibilities, but these must be found and brought to people's minds with appropriate marketing. Such an opportunity opens up in this area for the production of curio products. The production of capons creates an exclusive opportunity to bring our indigenous varieties to the market and to introduce their products to a wider circle. To this end, we have been capping and examining these products in terms of meat production and meat quality for years. In our work, we are looking for the answer to whether our indigenous chickens are suitable for the production of capon, as well as whether this curious product can stand its ground and how acceptable it is to consumers.

WASTE SLUDGE COMPOSITION AND POTENTIAL USE AS A FERTILIZER – A REVIEW

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Industries generate 2 billion tons of excess waste such as coal ash, phosphogypsum, red mud, lime mud and waste sludge annually. This therefore, calls for proper waste management and utilization. Recycling these wastes into agriculture sector inform of fertilizer is one sustainable utilization approach. In this review, we provide an overview of the composition of waste sludge and implications for utilization as a fertilizer. Results show that waste sludge is composed of an average; organic material (50–70%), mineral constituents (30–50%) mainly 3.4–4.0% nitrogen (N), (1–4% of inorganic carbon), 0.5–2.5% phosphorus (P), and other basic minerals. Waste sludge contained contaminants namely; adsorbable organohalogens, polychlorinated biphenyls, polycyclic aromatic hydrocarbons, hormones, pesticides, pharmaceuticals, surfactants and heavy metal like cadmium and lead, and pathogenic species. In conclusion, waste sludge contained a considerable amount on plant nutrients but its utilization as fertilizer requires reduction of contaminants that could pose a health threat to human health and environment.

IMPROVING OF MAIZE YIELD STABILITY WITH FOLIAR FERTILIZERS

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Increasing the yield stability in crop production is very important. Foliar fertilizers can be suitable for this purpose. In our study the effects of different foliar fertilizers were investigated for maize production. The experiment was set up in three replications, using random block design on the area of Hungarian University of Agriculture and Life Sciences in Szeged. The soil deeply salt meadow chernozem . The examined maize hybrid was DKC 4555. We applied three foliar fertilizers individually and combined with each other. 2021 was unfavourable year for maize. The amount of precipitation was lower by 113.58 mm than the average in the vegetative period of maize. We processed the obtained data by single factor variant analysis. The yield of the untreated control plot was 2.44 t ha^{-1}. By using of foliar fertilizer treatments we got higher yields (2.48-3.14 t ha^{-1}). Although the foliar fertilizer treatments resulted in maximum 29% higher yield in this experiment, but statistically it was not significant. Based on our results we can establish, that using foliar fertilizers can improve the yield stability of maize.

MICROPROPAGATION OF PHILODENDRON ERUBESCENS WITH THE USE OF DIFFERENT BIOSTIMULATORS

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In order to find the best type and concentration of biostimulators, *Philodendron erubescens* plants were *in vitro* propagated on different medium with 0.1-0.8 ml/l Pentakeep-V, the same dosages of Humus FW and 1-8 ml/l Titavit (in the case of control group, none of them were added). After the multiplication period, small plants were acclimatized in greenhouse without fertilization and biostimulator treatment (as substrate, white peat and vermiculite mixture in 2:1 ratio was used). In general, most of the plants' survival was more than 80-85%, and 2-4 ml/l Titavit or 0.2 ml/l Humus FW resulted the best values (95-100%), however, the latter product effected the least shoot and root development, the shortest leaves and roots, and the lowest leaf chlorophyll contents. Pentakeep-V was more suitable for faster and higher shoot production and optimal plant elongation, while Titavit stimulated rooting and enhanced leaf characteristics, but only in lower concentration (because the highest levels decreased these plant parameters). The biostimulators also have after-effects during the acclimatization (in spite of that these preparations were used only in the course of *in vitro* propagation), and compared to the control group, significant differences were shown. In summary, Titavit was the most effective, and Humus FW proved to be the least suitable.

PRECISION NUTRIENT APPLICATION TECHNOLOGIES IN CROP PRODUCTION

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Sustaining high crop production is hindered by soil infertility and many other factors. Yet, conventional supply of nutrients to improve soil fertility is raising concerns. Adoption of precision nutrient supply with a win–win alternative is recommended to ensure sustainability of crop production. Globally, different technologies are developed and utilized, hence there is need to comprehensively understand the advances and technologies used to deliver nutrients to crops. Therefore, the objective of this review was to assess the key technologies used to optimize nutrients supply to crops. Our synthesis revealed that nutrient variable rate technology, fertigation, and foliar fertilization were the common precision nutrient supply technologies used. Variable rate nutrient application delivered nutrients from both mineral and organic fertilisers matching exact crop requirements. Fertigation technologies included fertigation proportional fertilization and quantitative fertilization. In proportional fertilization and quantitative fertilization, rate of nutrient supply depended on the water-drip irrigation rate. Overall, the efficiency of nutrient delivery to crops was high in variable rate technology though it's utilization was hampered by barriers such as costs and inadequate internet coverage. We conclude that even if precision nutrient supply promises to provide a long term remedy to sustainable crop production, its wider adoption is only possible with commercial production of high value crops that ensure that farmers get over breakeven point.

RESPONSES OF SELECTED MAIZE GENOTYPES (ZEA MAYS L.) ON NITROGEN FERTILIZATION: GRAIN YIELD AND QUALITY ATTRIBUTES

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Maize is used as food, feed, and raw materials for industries. It is a more versatile multipurpose crop than wheat and rice. In many countries, particularly in SSA, Latin America, and a few countries in Asia, maize is a well-established and significant crop for human consumption and accounts for approximately 20% of food calories. It has a variety of roles as an industrial and energy crop in industrialized economies, where it is largely consumed as a livestock feed crop. Therefore, maize plays an important, diverse, and dynamic role in the global agri-food systems, and food and nutrition security. Thus, searching to improve the grain quality of maize remains important. This study aimed to assess the influence of nitrogen fertilization on maize hybrids in relation to the quality of grain. Using three nitrogen regimes (i.e 0, 90, and 150 Kg/ha) and three commercial hybrids a field trial was conducted. The result indicated a significant increase in protein content with nitrogen fertilization between hybrids. Additionally, nitrogen fertilization significantly increased yield, however, the high-yielding varieties indicated low protein content irrespective of nitrogen fertilization. To improve nutrition content and safeguard food security, this suggests, a need for maize genotypes with improved protein content and high yielding.

TECHNICAL AND CULTIVATION TECHNOLOGY RESEARCH AND DEVELOPMENT OF PRECISION CROP CULTIVATION ON THE SUBJECT OF CORN PLANTING

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Corn is very sensitive to environmental influences during germination. The germination period of maize is related to the quality of planting.

The latest precision technologies can be well applied to corn planters. I will present the effects of new precision planter systems for crops in my presentation. These effects are measurable on maize germination homogeneity, maize plant growth, and yield. New precision systems make plant to plant different setup on the planter. Precision systems work based on real-time data, precision systems work automatically. Precision systems adapt to the condition of the soil.

In my presentation I present a 3-season trial of a new corn planting technology solution from 2020 and 2022. My testing system is new. I did the planting in 4 different tillage systems. I worked on 1 parcel with conventional tillage (rotation) and 3 different plots without rotation (reduced tillage system, soil protection tillage system and strip tillage system).

My presentation shows that homogeneous germination has a significant effect on the yield potential of the crop. I measured the germination of the crop according to the sowing method and tillage method. I marked the plant with different germination times. I measured the unique product of each marked plant. The precision seed drill has a great effect on homogeneous germination. The results of my research show: more homogeneous crops will be, if we use a new system of planting technology.

GROWTH AND FEED UTILIZATION CHARACTERISTICS OF TWO COMMON CARP GENOTYPES REARED ON ARTHROPODAL FEED SOURCES

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In our experiment, we aimed to compare the growth and feed utilization traits of two common carp (*Cyprinus carpio*) genotypes fed with living arthropods (*Daphnia magna* and mealworm) or – simulating changes in zooplankton availability in ponds under natural conditions – with artificial feed combined with *Daphnia*. Fries of two carp genotypes ('Szeged Mirror Carp' and a scaled landrace from Derekegyháza, Hungary) were housed indoors in tanks of 900 litres. The experimental combinations/treatments were: mirror carp (Tr1) and scaled carp (Tr2) on live feed – 40 individuals per genotype; mirror carp (Tr3) and scaled carp (Tr4) on artificial feed/*Daphnia* – 20 individuals per genotype. From week 2, the differences both in body weight and in body length were significant between the two genotypes. By the end of the experiment (day 49), the average body weight and body length of the individuals fed with live feed (Tr1-2: 32.8, 27.8 grams/86.5, 81.1 mm) were significantly different from each other and from those achieved with artificial feed (Tr3-4: 18.1, 17.0 grams/74.6, 71.8 mm). Both the Average Daily Gain and the Specific Growth Rate values were higher for the 'Szeged Mirror Carp'. The final Condition Factor, however, was slightly higher for the genotype from Derekegyháza. At a total feed consumption of 109.9 grams per individual in 49 days, the Feed Conversion Rates were significantly lower for the 'Szeged Mirror Carp' and for feeding with live feed (Tr1-4: 3.38, 4.00, 6.15, 6.57 g g^{-1}). Our results confirm that feeding with living arthropods results in faster growing carp fries of better feed utilization efficiency in both genotypes compared to the effect of artificial feed. The two carp genotypes have different growth dynamics, the 'Szeged Mirror Carp' exhibiting faster development and more efficient utilization of feed.

„Supported by the ÚNKP-22-1 New National Excellence Program of the Ministry for Culture and Innovation from the source of the National Research, Development and Innovation Fund."

IN VITRO EFFICACY OF DISINFECTANTS AND FUNGICIDES USED IN THE CULTIVATION OF BUTTON MUSHROOM (*AGARICUS BISPORUS*)

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Weed moulds (*e.g.*, *Hypomyces*, *Lecanicillium* and *Trichoderma* species) are resulting in substantial economic losses in industrial *Agaricus bisporus* production. In order to prevent economic damage, the selection of the proper strategy of biological and chemical control is of utmost importance. The aim of this study was to evaluate the performance of some disinfectants and fungicides *in vitro* against the causal agents of cobweb (*Hypomyces odoratus*), wet bubble (*Hypomyces perniciosus*), dry bubble (*Lecanicillium fungicola* var. *fungicola*), and green mould (e.g., *Trichoderma aggressivum* f. *aggressivum*, *T. aggressivum* f. *europaeum*, *T. harzianum*), which are the top 4 most devastating mould diseases in button mushroom production.
Treatment with Sekusept Aktiv in the concentration range of 1.25-5% completely inhibited the growth of all examined weed mould strains. Terralin Protect, Disinflex and Formalin were also effective against most of the tested isolates except for *T. aggressivum* f. *aggressivum*, which proved to be the most resistant. Among the chemical fungicides, prochloraz was efficient against *Trichoderma* and *H. perniciosus* isolates, while metrafenone did not cause complete inhibition of any of the isolates, even at the highest concentration (5%) tested. For both fungicides the lowest growth rate inhibition was recorded towards *Lecanicillium* isolates.
This study was carried out with the financial support of project 2020-1.1.2-PIACI-KFI-2020-00111 (Széchenyi 2020 Program); and of the Doctoral Student Scholarship Program of the Co-operative Doctoral Program (Ministry of Innovation and Technology financed from the National Research, Development and Innovation Fund, KDP-2021- C1764158, to A. Misz). The authors thank Dr. Lóránt Hatvani and Dr. András Geösel for microbial strains.

SOIL PESTS PROBLEM IN SWEETPOTATO (*IPOMOEA BATATAS* (L.) LAM.) PRODUCTION IN SOUTH HUNGARY

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Samples of sweet potatoes from southern Hungary have shown feeding damage from either wireworms (*Agriotes spp.*) or white grubs *(Melolontha melolontha).* The *Melolontha melolontha* is a relatively common European insect species and the most important agricultural insect species in The Carpathian Basin. The larves causes the damages for both. White grubs bore large shallow holes into sweet potato roots that result in large feeding sites. During the monitoring season. I have observed that white grubs can be found more in sandy soils, wire worms are monitored in hard alluvial soils. Wireworms are important soil dwelling pests world-wide causing yield losses in many crops also in sweetpotato. Wireworm damage is often described as "shot-holes". Wireworms are widespread, with different species and genera present in various countries. One of the most dangerous soil pests in Hungary. Wireworm scars are usually randomly scattered over the root. It is very difficult to find in soil samples and in damaged roots, on the other hand white grubs are easily detectable. Wireworms and white grubs can cause considerable damage to storage root marketability. They can cause suchsevere damage to the crop that they are unsaleable. Soil-applied insecticides are usually effective in reducing damage, but in Hungary is not allowed to use inseticides because sweet potato is still a new crop in Hungary. Control of wireworms and white grubs before or during planting is allowed to use microbiolocial soil disinfectants. Experimental control methods, using parasitic nematodes and spores of the fungus Beauveria bassiana have been successful in controlling damage.

THE EFFECT OF ARBUSCULAR MYCORRHIZA ON THE YIELD OF DIFFERENT WINTER WHEAT VARIETIES AT FOUR NUTRIENT LEVELS.

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The examination of mycorrhizae is a very important research topic nowadays, as it is known for its many positive effects and can be found on almost all soil types. They are able to form a symbiotic relationship with the majority of terrestrial plants, with almost 90% of them. They increase the nutrient and water absorption of the host plant, increase the resistance of the plant against diseases and help improve the quality of the soil. In return, the fungus receives organic matter, vitamins and growth-stimulating substances from the plant. However, few studies deal with the mycorrhiza-wheat relationship under field conditions. In our research, we focused on this, where we created four different nutrient levels and treated four varieties of winter wheat (GK Déva, GK Petur, Cellule, MV Nádor) with a biological seedcoating product that contain mycorrhiza. The experiment was set up in Szeged-Öthalom, in the 2021/2022 growing season, on 10 m^2 plots in four replicates, using random block arrangement. Our goal was to determine the effectiveness of mycorrhizal treatments in addition to traditional field cultivation. To do this, we measured the yield amounts and examined different yield elements (stem weight, spike weight, spike length). Then the results of the treated and control plants were compared and evaluated using the SPSS statistical system. Based on the one-year results, we observed that mycorrhizal treatments had a positive effect on the yield of winter wheat varieties at all nutrient levels.

THE IMPLICATIONS OF EUROPEAN GREEN DEAL ON AGRICULTURAL SYSTEMS

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Climatic changes have affected the agriculture and in many rural areas, the urge for intervention can be observed. The necessity for trans sectorial intervention is underlined by the European Green Deal, which represents a set of politics initiatives towards placing the European Union on a green transition with the final scope to reach the climatic neutrality till 2050. Through research methods based mainly on the study of programming documents and aggregated data at the European level, it was aimed to highlight the main implications that the European Green Deal has on agricultural systems, especially through actions that include the reform of the Common Agricultural Policy, strategic national plans, the action plan for organic agriculture, the policy for the promotion of agri-food products, the welfare of farm animals, the sustainable use of pesticides, and last but not least the nutrition label of products.

ENVIRONMENTAL PROTECTION AND WILDLIFE MANAGEMENT

A REVIEW OF THE HUMAN WILDLIFE CONFLICTS AROUND THE NAIROBI NATIONAL PARK, KENYA.

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Human-wildlife conflicts are one of the most important challenges facing wildlife conservation. The Nairobi National Park (NNP) experiences various pressures due to its small size and close proximity to an expanding city. The unfenced southern part of the park is the main hotspot forthe conflicts. A review of 22 publications related to NNP published between 2012 and 2022 was conducted to identify the types, causes, and the mitigation measures of conflicts around the park. Data for the review was collected through Google Scholar, Web of Science and Scopus. Our results indicate that livestock predation linked to lions is the major type of conflict superseded by retaliatory killings of the carnivores by the local communities. Other conflicts include crop raids by ungulates and the spread of diseases especially the East Coast fever that is transmitted from the wildebeest to livestock. This has prompted most farmers to fence off their parcels to prevent their livestock from being exposed to wildlife. Findings further reveal that one of the main causes of the conflicts is the expanding human population, which has encroached on wildlife dispersal corridors. It resulted in land subdivision and fencing of the farms that has greatly impeded wildlife migration. Mitigation methods in place include compensation schemes and landowners leasing their farms to the park management so that the corridors can be left open for free wildlife movement. These have been ineffective therefore there is still a need to find sustainable mitigation measures that ensure coexistence between humans and wildlife.

COMPARATIVE ANALYSIS OF THE MACROINVERTEBRATE FAUNA OF ECOLOGICALLY STABLE AND TRADITIONAL GARDEN PONDS

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Freshwater habitats are considered to be highly vulnerable globally. For some species, mainly invertebrates, artificial ponds created to decorate urban gardens provide sufficient habitat or function as a stepping stone. However, traditional garden ponds require expensive and energy- consuming machinery to maintain their aesthetic appearance, which can lead to the release of synthetic chemicals into the environment that can harm wildlife. In contrast, the ecologically stable garden ponds, which are distinguished from the traditional garden ponds by their design and the complex ecosystem that maintains them, offer a solution for the problems of eutrophication and succession, and maintain optimal water quality in an environmentally and cost-effective way. The objective of this study was to compare the aquatic macroinvertebrate fauna diversity between traditional garden ponds and ecologically stable garden ponds that were designed and constructed by the first author. Five ponds of both types were examined, via collecting biological specimens from 90 sampling point. Altogether 45 species were identified, and one taxon at genus level. Twenty-one macroinvertebrate species were present in both types of ponds, while two species were found only in traditional garden ponds and 23 species were identified only in ecologically stable garden ponds, of which one species is protected by the law. Our statistical analysis indicates that the macroinvertebrate fauna of ecologically stable ponds is much richer in terms of species abundance compared to that of a traditional garden pond.

CONTRIBUTION OF NATURE CONSERVATION RELATED CITIZEN SCIENCE PROJECTS TO LEARNING, ATTITUDE AND BEHAVIORAL CHANGE OF PARTICIPANTS

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Nature Conservation related Citizen Science (NCCS) is an emerging area of research and practice where volunteers take part in a scientific process, usually focusing on data gathering or monitoring for conservation purposes. Their observations and data have been reported to contribute to nature conservation and science, but research on the potential of NCCS in changing the behavior, attitudes, and learning of participants has started to emerge as well. Here we present a review of studies where questionnaire surveys were used to measure the impacts of NCCS projects on learning, attitude, and behavioral change of volunteers during and after their participation in the projects. Our results show that many NCCS projects have enhanced learning of participants in different areas, (e.g. increasing knowledge on species recognition, understanding the scientific process, and the conservation of species and habitats). On the other hand, studies show that participation affected the participants' attitudes toward nature conservation. Participants started to appreciate some species and nature more which led to taking action for their conservation. We describe the common characteristics of NCCS projects, where gains in knowledge were linked to attitude and behavioral changes. These can be used as recommendations for further NCCS project design, and the improvement of current CS initiatives to aid nature conservation.

EFFECT OF WILD BOAR ROOTING ON SOIL CHARACTERISTICS IN VÖRÖSKŐVÁR, BUDAPEST, HUNGARY

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Wild boar (Sus scrofa) changes the physical and chemical parameters of the soil by trampling and rooting in search for food, particularly during the colder months of the year. These effects have been identified both in its native and invasive ranges, but there is still few knowledge in the literature related to the specific impact of the rooting behaviour on soil attributes in relation to different areas of a rooting (i.e., rooting, its ring, control). In this study, 5 deep rootings were sampled in Vöröskővár, Budapest, Hungary, in January of 2023, and analysed with a Near Infrared Spectrometer (NIR) to compare differences in the soil characteristics. The results demonstrate an evident decrease in the Soil Organic Matter (SOM) in the rooted area in comparison with the control area. Significant correlation was identified between Phosphorus, Nitrogen, Magnesium, and Potassium contents in the soil, but there were no significant differences between the ring and the middle of the rooting, or these and the control sample. Further analyses over an entire year are planned to identify the long-term impact of this feeding behaviour on the soil in the framework of project funded by the National Research, Development and Innovation Office in Hungary (RRF-2.3.1-21-2022-00006).

MICROALGAL BIOPESTICIDES AS A SUSTAINABLE SOLUTION FOR PLANT PROTECTION

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Increasing awareness about the detrimental effects of synthetic pesticides including environmental pollution, pesticide-resistant pests and negative impact on beneficial organisms has promoted the use of biological control agents as an integral part of Integrated pest management. Microalgae are photosynthetic organisms that produce a variety of bioactive compounds with diverse application possibilities in plant protection. This review provides an in-depth examination of microalgae with the potential to synthesize bioactive compounds with biopesticidal activity. This review integrated findings from laboratory research to describe and evaluate several microalgae strains in the context of plant protection in an attempt to enhance our understanding of the potential of microalgae in sustainable agriculture. The review reveal potential for further exploitation of microalgae-derived biopesticides in plant protection as utilizing their antibacterial, antifungal, and insecticidal properties. To summarize, microalgae-derived biopesticides have shown promising results as a sustainable and environmentally friendly alternative to synthetic pesticides for the effective control of agricultural pests.

MORPHOLOGICAL AND ANATOMICAL CHARACTERISTICS OF NUTRIA (MYOCASTOR COYPUS) IN A SLOVAKIAN POPULATION

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Nutria (Myocastor coypus) has been present in Europe since the 19th century. Despite this fact, wildlife management and nature conservation do not obtain enough knowledge about this invasive, non-native species. The main purpose of this study was to collect more information about this rodent, and to answer on those questions: 1) What body sizes do nutria females and males have compared to each other, are they in good condition for a successful reproduction?; 2) Can the reproduction of nutria be confirmed based on the examination of the reproductive organs, and what we can reveal about their reproductive strategy? We collected animals by hunting rifles and trapping in different periods of a year. The carcasses were analysed in the laboratory, measuring the body weight, body, head, tail and hindfoot lengths, and observing the reproductive and digestive organs. We found that most of the animals were in good general condition. The different body sizes showed higher absolute values for males than for females. The body weight for males could reach 10,1 kg. We confirm that the nutria is highly reproductive. We found signs of reproduction in 62% of females from May to October, and even during October we could find 10 embryos for a specimen (the most was 11 embryos). Since the nutria is a non-native, invasive species, which is harmful in several ways to the ecosystem, moreover, highly reproductive, there is a need to eradicate them and stop their range expansion. Within the framework of our ongoing we plan to collect additional data on the species from Hungary.

POLLEN CONCENTRATION DATA SET FOR XANTHIUM SPP. IN 2019 IN THE NORTHERN GREAT PLAIN REGION

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Pollen concentrations of *Xanthium spp.* were analyzed in air samples collected with a 7-day Hirst-type (Burkard) pollen trap placed in the Northern Great Plain region (Jász-Nagykun-Szolnok county, Szolnok; Hajdú-Bihar county, Debrecen; Szabolcs-Szatmár-Bereg county, Nyíregyháza) in 2019. The pollen season was defined as the day on which the sum of the daily average pollen concentration reaches 1% of the total amount and the end of the season was defined when it reaches 99%.

The highest annual total pollen count was detected in 2019 in Jász-Nagykun-Szolnok county (91 pieces), and the lowest in Szabolcs-Szatmár-Bereg county (41). The highest amount of pollen grains were counted on the 24th and 27th of August (9 pollen/m^3) in Szolnok. The highest daily concentration was detected on August 21st (8 pollen/m^3) in Debrecen. The highest daily value was recorded on August 25th (4 pollen/m^3) in Nyíregyháza.

Pollen monitoring provides information on the size of *Xanthium spp.* stands.

SPATIAL PATTERN OF SMALL MAMMAL POPULATION DENSITY IN THE AREA OF LISZT FERENC AIRPORT, BUDAPEST

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Apart from their several positive and regulatory effects on ecosystems, small mammal species can cause significant damage in certain cases. For instance, they can indirectly endanger the safety of aircrafts, which is a crucial issue in the daily operation of airports. As potential food resources, they can attract and thus aggregate both bird and mammalian predators around the runways. Among these, birds of prey can cause especially dangerous situations during landings and take-offs. As a prevention, the population density of small mammal species should be kept at the lowest possible level with cost effective and environmentally conscious treatments. To achieve this, however, it is necessary to know both the spatial pattern of small mammal population density and the habitat preference of these species. The purpose of our investigation was therefore to study these mentioned parameters in the area of Liszt Ferenc Airport operated by Budapest Airport Zrt. According to our results based on small mammal hole density, the population is aggregated directly beside the runways, while the hole density of rodents shows a significant decrease further away from them. This trend is also reflected in the habitat preference analysis. Sample areas nearest to the runways were preferred, while avoidance was detected towards the stripe transects of more than 20 m away. Therefore, we suggest focusing the activities and treatments regarding flight management and habitat destruction on the immediate vicinity of runways, and also including the necessary measures in the integrated Wildlife Hazard Management Plan.

SUCCESSFUL COLONIZATION OF FOREST STEPPE SPECIES IN DIFFERENT AREAS ABANDONED FROM TRADITIONAL CULTIVATION

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The Eurasian forest steppe belt stretches between closed forests and steppe zones. It is a complex and diverse vegetation type providing an important habitat for many endangered species. Over the centuries, among others historical land use practices played a major role in shaping the appearance of the forest steppe zone. At international level in nature conservation the fragments that remained in their natural state are considered of high importance. There was relatively little information available about the recolonisation ability of forest steppe species. Therefore, we examined changes in texture and structure in these species during secondary succession in different abandoned areas in the Carpathian Basin. Forest steppe species mainly from *Festuco-Brometea* group had significant species number, cover and diversity values in all three investigated types in the oldest fallows. The increase in the number and cover of forest steppe species in abandoned grasslands revealed that the replacement of the species pool of these grasslands is not necessarily only accompanied by degradation, but also by the appearance and spread of valuable natural species given the habitat is sufficiently patchy. As abandonment progresses, the proportions of species habitat categories diminish in abandoned vineyards and arable land. Three decades after abandonment, the cover rates of disturbed habitats species were negligible for all three types examined, indicating a change in the quality of the species pool.

APPLICATION OF 3D PRINTED TURBULENCE PROMOTER IN DAIRY WASTEWATER ULTRAFILTRATION

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The food industry, such as the dairy industry generates the large volume of wastewater due to the high water consumption during technological operations, washing and cleaning. Many different methods such as biological and physico-chemical methods are used to treat dairy wastewater efficiently but they have their disadvantages (high operating costs, high space requirements, operational difficulties). Membrane technologies are promising methods to treat dairy wastewaters. The main disadvantage of membrane filtration in dairy wastewater treatment is membrane fouling, which causes flux decline, decreased membrane life-time, and increased operational cost.

One way to reduce the fouling is to increase the surface shear rate of the membrane. The method for increasing shear rate is to change flow properties (stirring and using 3D printed turbulence promoter). 3D printing technology and membrane module design, it could potentially address the membrane fouling problem through the optimization of spacers to increase mass transfer and reduce the concentration polarization at the membrane surface.

Ultrafiltration (*UF*) experiments were performed model dairy wastewater with different transmembrane pressures (0.2, 0.3 and 0.4 MPa) and stirring velocities (200, 300 and 400 rpm). Polyethersulfone (*PES*) UF membranes with molecular weight cut-off (*MWCO*) of 50 kDa and polylactic acid (*PLA*) 3D printed spacer configurations were used. The permeate flux values, resistances and membrane rejection were examined and the effect of spacer was observed.

Acknowledgements: The authors are thankful for the financial support of the NKFI-FK-142414 project, (BO/00576/20/4) and the ÚNKP-22-5-SZTE-210.

BEHAVIOR PATTERN OF ROE DEER AT FEEDING PLACES REVEALED BY CAMERA-TRAPPING IN THE HUNGARIAN GREAT PLAIN

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In the Hungarian Great Plain the roe deer (*Capreolus capreolus*) is one of the most important species for wildlife management. The supplementary feeding of roe deer in Hungary is a traditional habit, it can be beneficial for deer to survive and keep body condition during winter. In our study we aimed to know the behavioural habits of roe deer at feeding places. The data were collected in two wildlife management units in Jász-Nagykun-Szolnok county in Hungary from winter of 2019 until spring of 2020. Roe deer followed a temporal trend, with higher numbers around feeders in colder months and lower numbers in warmer months. Their visits followed a bimodal activity pattern that was characterized by peaks of activity at dawn and dusk. We were able to link the presence of snow cover and precipitation to an increase in the feeding activity of roe deer. It is important to understand that the presence of deer at the feeder does not reflect on the actual biological effect of the use of feeders on deer. Game managers should identify what the main goal of the feeding is and think of how to validate the effectiveness of this expensive intervention. We suggest at least to measure how much of the supplemented feed actually makes up the diet of roe deer individuals. However, it would be the most reliable approach to analyse the physiological and biological differences between fed and non-fed deer.

FINANCIAL PERFORMANCE OF ROMANIAN WASTE COLLECTION BUSINESSES

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Currently, the world population is continuously increasing, as are consumption and demands for cleanliness. There will always be garbage, and even if its disposal is getting more and more expensive every year, someone has to deal with it. Also, climate changes are increasingly common in many places on Earth, and the lack of coherent measures in the direction of environmental protection will strongly affect future generations. In this context, waste collection represents an important stage in the transition to a sustainable lifestyle. Waste collection is a stable business model that is resistant to any crisis.

In Romania, the growth registered by companies active in the field of garbage collection is not spectacular, but it is constant. In 2021, 1,108 companies were registered whose business is waste collection, with a total number of 26,394 employees, 981,376,916 euros in net turnover and 66,044,088 euros in net profit. Compared to 2020, the turnover registered an increase of 18.41%.

PRELIMINARY METHODOLOGICAL EXPERIMENTS ON THE HYDROPHILIC/HYDROPHOBIC CHARACTER OF SOILS USING KRÜSS DSA 100 DROP SHAPE ANALYSER

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In our experiments, we used Krüss DSA 100 drop shape analyzer to test the wettability of different Hungarian soil and sediment samples, which measures the contact angle (cA) and water drop penetration time (WDPT), excellent indicators of the wettability of the solid phase. Two methods found in the literature were tested in the preliminary experiments. In the pastille method (PM), distilled water was dropped onto soil disc samples prepared at different pressures, and the cA and WDPT were measured. In adhesive stripe method (ASM) only the cA was measured. During our measurements, we varied the brightness according to our experience. We tested the corresponding frame rate values. We chose Sessile drop method with Young-Laplace fitting and automatic baseline adjustment. Calibration was performed before measuring each sample, measurements were performed in several replicates. The cA and WDPT was also measured by the PM on a series of previously hydrophobized soil samples treated with CPC cationic surfactant. The two sample preparation methods mentioned above (PM and ASM) were used to determine the hydrophobicity order of the soil samples. In PM measurements, a verifiable difference in cA values was observed for pastilles produced at different pressures. For both methods, the hydrophobizing effect of the cationic surfactant was clearly detectable. The results confirmed that the hydrophobic character determined by cA measurement and the measured WDPT values are closely related. The correct adjustment of the frame rate value may be crucial for accurate contact angle measurements.

THE EFFECT OF ADDING DIFFERENT OILS ON LIQUID WHOLE EGG SENSORIAL PROPERTIES

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Eggs are known as a high dense-food, an egg can provide 75 Kcal and up to 7 grams of protein depending on its weight. Egg proteins are known as high quality proteins due to their high digestibility. Due to their longer shelf-life and safety in a microbiological point of view egg products are commonly used in Europe, almost 20% of total egg consumption is from egg products. Adding flavors and fortifying egg products to increase the benefits and customer acceptance is the aim of this study. Olive oil, sunflower oil, palm oil, and coconut oil were added to liquid whole eggs to evaluate their effect on the sensory attributes. All mentioned oils have a great antioxidant activity and phenolic content, olive oil for example is known for its positive effect enhancing cardiovascular health . Meanwhile, sunflower fatty acids are known for their ability to decrease the plasma lipoproteins and total cholesterol. Palm oil as well is one of the most used oils in food manufacturing and well known for its content of antioxidant compounds, meanwhile coconut oil has a unique composition of medium chain fatty acids which influence its nutritional value. 2.5, 5, 7.5% V/V of olive oil, sunflower oil, palm oil, and coconut oil were added to pasteurized liquid whole eggs then samples were cooked into scrambled eggs to be evaluated by trained panelists. They agreed that sunflower 5% and coconut 2.5% were the best in terms of color, taste and texture and coconut 5% and palm 5% smelled the best.

BOTANICAL OBSERVATIONS IN THE NATURE CONSERVATION AREA OF HAJÓS

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Our research area is located north-northeast of the Cellar Village of Hajós settlement, which is bordered by the Danube-Valley Main Canal and Road No. 54. This area can be classified as part of the sandy steppe group according to the ÁNÉR (New habitat classification and manual for standardized habitat mapping). During the research, our primary task was to identify and estimate the population of protected plant species along the route of a planned cycle path. During the field tour associated with the survey, a quadrature method was used, with the help of which percentage coverage values were determined. Looking at the vegetation of the first section of the area (on the side of Császártöltés), it can be concluded that the stand is a highly diverse, closed grassland, in which, in addition to perennial grass species, the proportion of dicotyledonous taxa is high. In this part of the trail, we also found a separate specimen of the sandy iris (*Iris arenaria*). The second section runs over higher ground, dominated by the vineyard weed community. At the beginning of the third section there is a diverse sandy meadow, and the end of the trail connects to the Cellar Village of Hajós through a softwood forest. The two protected plant species (*Apium repens* - creeping marshwort, *Cirsium brachycephalum* - small-nested thistle) indicated in the area are not found along the cycle path. We recommend *in situ* (or possibly *ex situ*) practices for the preservation of the protected iris (*Iris arenaria*).

COMPARATIVE STUDY OF THE FLOWERING PHENOLOGY OF WILD GROWING GEOPHYTES IN TWO DIFFERENT MESOCLIMATIC AREAS IN THE CARPATHIAN BASIN

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Global climate change has unforeseeable ramifications for the ecosystem of our planet. Plant phenology - timing of cyclical or seasonal biological events e.g. leaf appearance, flowering and fruiting - has proven to be a very sensitive indicator for climate change impacts. The phenology of many plant species has been advanced by warming, with earlier spring species being more sensitive. To understand better the driving factors of the changing phenology we investigated the phenology of different wild growing geophytes in the Carpathian Basin (Central Europe) for three consecutive years. The study has been carried out as an *ex situ* experiment in two different mesoclimatic sites, one in the Gödöllő Botanical Garden of the Hungarian University of Agriculture and Life Sciences (average temperature 11,35 °C), other in the Eötvös Loránd University Botanical Garden, Füvészkert in the central part of Budapest (average temperature 13,16 °C). During the experiment horticultural propagation of 5 wild growing geophytes (*Galanthus nivalis, Eranthis hyemalis, Convallaria majalis, Iris pumila, Polygonatum multiflorum*) were examined. Standard conditions were set for the plants at both locations. The results show an advance of 5.61 days in Budapest, with strong variation across species. The earliest flowering species (*Galanthus nivalis* and *Eranthis hyemalis*) died by the 3rd year in the site Budapest. If global warming continues, this advance and negative effects on wild growing plant species might be more serious in the future.

EFFECTS OF HIGH NUTRIENT AND HEAVY METAL CONTAINING SOILS ON SOME CHEMICAL AND BIOCHEMICAL FEATURES OF SUDAN GRASS

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In this research we studied the effects of different soil amendments on the elemental composition and the activities of some enzymes of a Sudan grass variety (GK Csaba). In the pot experiment we used a soil with low heavy metal content as a plant grow media, as a control (C) we used the same soils „enriched" with a 20% wastewater sediment (WS) (originated from a former wastewater settling plant), a 10% compost (made of sewage sludge and green waste, SG), or their mix (C + 10% SG + 20% WS). The compost contained much more essential plant nutrients, while the wastewater-sediment was rich in toxic heavy metals compared to control soil. In this study, we determined the elemental composition of soil and organs of the plants (roots, leaves) and activities of some enzymes in leaves. Higher concentrations of all essential plant nutrient were detected in both roots and leaves of the treated plants. The concentration of copper and zinc were significantly higher (2 and 3 times higher, respectively) in plants grown in WS containing media (C+20% WS and C+10% SG + 20% WS). The concentration of toxic heavy metals were higher in roots compared to leaves. As an exception, the cadmium concentration was nearly equal in the roots and the leaves, showing that this element's accumulation is not limited to the roots, but was also transported into the leaves. The activities of the examined enzymes ((glucose-6 phosphate dehydrogenase, G6PDH; isocitrate-dehydrogenase, ICDH; peroxidase, POX) did not show significant changes in presence of WS and SG.

HISTORICAL ECOLOGICAL RESEARCH OF THE KURGANS OF HAJDÚNÁNÁS–ZAGOLYA-DŰLŐ

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Kurgans are man-made geomorphological elements of the Eurasian steppe zone. In the Carpathian Basin, their construction is linked to the burial customs of Bronze Age societies, however their importance is multifold and isn't limited to their archaeological significance only. These formations are also carriers of significant botanical, zoological, pedological and geomorphological values, and as key elements of the cultural heritage they represent unique aesthetical and culture historical significance within the landscapes of the Great Hungarian Plain. Within the vicinity of Hajdúnánás, the so called Zagolya-dűlő gives home to multiple burial mounds. The history of this territory arches over – at least – five millennia, starting with the construction of these burial mounds. The current study focuses on the historical ecology of Zagolya-dűlő by integrating various environmental and historical sources. Results of the paleopedological analysis of one of the kurgans reveal data on the contemporary environmental conditions, while the detailed landuse historical assessment helps to understand the significance of the territory and the role of the kurgans within the later ages. To complete the condition assessment of the kurgans basic soil and botanical survey were also performed and will be reported on.

INVESTIGATING THE EFFECT OF CLIMATE CHANGE ON THE LAND USE AND LAND COVER OF THE JORDAN RIVER BASIN

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Climate change impacts the world's ecosystems and alters many regions' land use and land cover (LULC). The Jordan River Basin is an important region for both its natural resources and cultural heritage, making it essential to understand the effect of climate change on its LULC. This study aims to use regression analysis, including remote sensing and GIS techniques, to investigate the impact of climate change on the LULC of the Jordan River Basin. The regression analysis was performed using climate change data as the independent variable and LULC data as the dependent variable. The data was collected over a period of several years, and remote sensing and GIS techniques were used to analyze the LULC data and identify changes over time. The regression analysis results showed a significant relationship between climate change and LULC changes in the Jordan River Basin. The study found that changes in the climate variables were associated with changes in LULC, including increased urbanization, deforestation, and changes in vegetation patterns. The study concludes that climate change has a significant impact on the LULC of the Jordan River Basin. The use of regression analysis and remote sensing and GIS techniques is an effective way to study this impact. The results of this study provide important information for decision-makers and local communities to protect the resources of the area. These findings highlight the importance of continuous monitoring and analysis of LULC changes, to better understand the effects of climate change and to mitigate and adapt to these impacts.

THE EFFECT OF HEAVY METAL CONTAINING WASTEWATER SEDIMENT ON THE MICROANATOMICAL CHARACTERISTICS OF THE LEAVES AND STEM OF *SALIX VIMINALIS*

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A comparative microanatomical study of *Salix viminalis* shoots was performed in order to get an idea of the effect of toxic elements stress on the microanatomical parameters of the shoot (leaves, stem). The examined *Salix viminalis* shoots originated from Lovász-zug suburban area of Debrecen city, where formerly a sewage settling pond was operated as a secondary biological purification unit. The control *Salix triandra x viminalis* L. 'Inger' samples originated from the Nyíregyháza experiment with uncontaminated soil. As a result of our reasearch, we can state the following in the case of the leaf samples grown on contaminated soil: the leaf lamina thickness decreased; the extent of the palisad parenchima decreased; the extent of the intercellular spaced increased inside the spongy parenchyma; the width and the height of the main veins increased; the extent of the collenchyma bordereing the main vein increased; the stomatal density increased both in the case of adaxial and abaxial epidermis; the size of the stomas decreased. In the case of the stem samples we observed the following: in the case of the samples grown on contaminated soil the extent of the primer cortex increased; the cell wall of the cells building the sclerenchimatic fibers thickened; the number of Ca-oxalate crystal rosettes and sclerids increased; the extent of secondary phloem – mainly the extent of hard phloem - increased; the lumen of the tracheas in the secondary xylem increased; the avarage width of the annual rings deacreased; the extent of the central stele of the stem increased.

THE PORTRAYAL OF WILD BOAR ON SOCIAL MEDIA IN MALAYSIA

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Malaysia has a high density of wild boars, with more than 2.5 million individuals populating the area. In recent years, Malaysia's large wild boar population has inhabited ever- increasing human-dominated landscapes, frequently resulting in human-wild boar conflicts. The ways by which social media portray wild boars influence the local perceptions of human- wild boar conflicts. This study determines the conflict between local communities and wild boar in Malaysia by (1) assessing how the social media portray human–wild boar interactions in Malaysia and its influence on local perceptions; and (2) identifying suggested policy and management solutions. The results show that portrayals of wild boar on social media in Malaysia have become increasingly negative, even when covering the human-wild boar interactions that incur no injuries or harm. Consequently, negative portrayal might lead to lower tolerance toward wild boar and decrease local support for conservation. In conclusion, the picture of wild boars on social media reflects the complex and often conflicting local perceptions towards these wild animals, highlighting the need for an evidence-based approach and involvement of researchers and conservation practitioners on social media to manage human-wildlife conflict.

FOOD PROCESSING AND SAFETY, RURAL AND SUSTAINABLE DEVELOPMEN

EXAMINATION OF CONSUMER ATTITUDES REGARDING THE CONSUMPTION OF NOVEL FOODS, ESPECIALLY DUCKWEEDS

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Nowadays, the environmental damage caused by food production and the large-scale use of resources are causing an increasing problem. The ever-increasing population of the planet needs to be fed, and in many regions it is particularly difficult to supply the population with the right amount and quality of food. Researchers are working hard to solve the problem of providing adequate nutrients in a sustainable way. From December 2021, 2 species of duckweeds, *Wolffia arrhiza* and *Wolffia globosa*, were registered as novel foods in the EU. Both species belong to the *Lemnaceae* family. In case of freeze-drying, the protein content is between 20-30%, the starch content is 10-20%, and the dietary fiber content is around 25%. The fat content ranges from 1-5%. In addition to these components, there are many other useful components in *Wolffia*, for example various vitamins (tocopherols, ß-carotene, lutein) and minerals. In terms of their composition, we can rightly classify these plants in the "superfood" category, using a fashionable term. During my research, I mapped the general knowledge of consumers regarding the concepts of superfood and novel food. I specifically covered duckweed, as well as consumer habits and knowledge about alternative protein sources. I drew my conclusions based on the completed questionnaire survey.

„SUPPORTED BY THE ÚNKP-22-4-SZTE-205 NEW NATIONAL EXCELLENCE PROGRAM OF THE MINISTRY FOR CULTURE AND INNOVATION FROM THE SOURCE OF THE NATIONAL RESEARCH, DEVELOPMENT AND INNOVATION FUND."

HETEROLOGOUS PROTEIN EXPRESSION OF MUCOR LUSITANICUS COTH AND HSBA GENES IN PENICILLIUM CHRYSOGENUM AND PICHIA PASTORIS

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Hydrophobic surface binding A proteins (HsbA) belong to the galactomannoprotein family (1) as major components of the fungal cell wall that is released during the growth of fungal hyphae. Our previous studies suggested HsbA proteins influence the biofilm formation and virulence in *Mucor lusitanicus*. Furthermore, CotH3 and CotH4 proteins mediate the process of fungal infection in a cell-wall-dependent manner and play an important role in the pathogenesis (2).

The aim of the present study is to achieve heterologous protein expression of CotH and HsbA proteins in *Penicillium chrysogenum*. Expression plasmids were constructed to able the insertion of the single gene of interest and express the protein inside of the recipient strain. Recombination of the *cotH* and *hsbA* genes into pSK275paf plasmid was performed and transformation procedure was carried out by protoplast formation of *P. chrysogenum*. Transformants were obtained and selected by using minimal media supplemented with phyrithiamine. The heterologous protein was purified and verified with SDS-PAGE and visualised by Coomassie blue and silver staining. The presence of the CotH4 protein was confirmed by MALDI-TOF MS analysis of the fermented broth.

We have started to construct an expression plasmid for heterologous expression of CotH and HsbA proteins in *Pichia pastoris*, using pPICZα vector with an inducible promoter. Proteins were phused with HIS-tag for easier purification. The transformation experiments are ongoing.

This study was supported by the grants NKFI K131796, ELKH 2001007, NKFI TKP-2021-EGA-28. C.S. is supported by the ÚNKP-22-4 -SZTE-523 New National Excellence Program of the Ministry for Innovation and Technology from the source of the National Research, Development, and Innovation Fund.

OCCURENCE OF DEOXYNIVALENOL IN WINTER WHEAT GRAINS HARVESTED IN HUNGARY OVER THE YEARS 2012-2017

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Deoxynivalenol (DON) is the most important regulated mycotoxin associated with wheat grains. Contaminated wheat and wheat products constitute a serious hazard to health of human and livestock. Monitoring their occurrence in grains is necessary in order to indirectly ensure food safety. Over a six years period, presence of DON in 5806 unprocessed winter wheat grain samples collected from all wheat growing regions of Hungary were evaluated by SGS Hungária Ltd. Samples were analyzed for DON contamination by accredited laboratories using a validated HPLC-method. The detected concentrations were generally low as mostly local epidemics occurred in Hungary during this period. However, harmful levels of DON were found in many samples (up to 6.15 mg/kg). Contamination levels varied moderately between years and counties. The samples collected from the south and south-east regions of the country showed the highest levels of toxin contaminations. In 2015, in case of three out of the nineteen counties, the observed average DON concentration levels were higher than the EU threshold. This work can contribute to the development of predictive models and to the potential adjustments of maximum levels set by authorities.

SUSTAINABLE RURAL DELVELOPMENT THROUGH THE UTILIZATION OF INVASIVE ALIEN SHRUBS TO PRODUCE LOCAL BIOENERGY

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Invasive species are considered the second biggest threat to global biodiversity. Amorpha fruticosa, a very aggressive alien invasive plant, has colonised a large part of the floodplains of the Tisza and the Hármas-Körös rivers. This high density shrub increases flood risk, increases the cost of agricultural land use, fragments habitats and reduces biodiversity. A local community, along the river Tisza, started to develop a pilot project to use this shrub as a local natural resource. One of the biggest challenges facing this local community, like many others, is the energy supply to public institutions and households. The initiative is based on the concept that these invasive plants have high energy content and can be converted into bioenergy. The local municipality with other stakeholders set up a pilot project along the river Tisza, began to eradicate this shrub and established a local biomass supply chain to harvest and convert invasive plants into woodchips. The produced woodchips, as bioenergy source is utilized in biomass boilers that produce green heat for local public buildings, as well as transported to a heating plant. On the one hand, in order to prevent the encroachment of invasive alien shrubs and to ensure the continuous production of biomass, the public authority established a native tree plantation for energy. The project has already delivered multiple impacts both for the community and the environment, such as the substitution of natural gas, CO2 emission reduction and heating cost saving annually.

TEXTURAL INVESTIGATION OF A PROTEIN RICH JELLY SWEET

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Today's most interesting nutritional issue might be the accurate protein intake (in quantity as well as in quality point of view). In our research a protein rich jelly type sweet (gummy bear) is developed and investigated. The product is made of an egg white based milk replacement product called "ToTu drink", erythritol, bovine gelatine and fruit pulps (mango, red berries and bananas). The aim of this study is to evaluate the protein rich product's textural properties in function of protein concentration. For that purpose a TPA (textural profile analysis, SMS TAXT Plus texture analyser) was used for evaluation of textural profile of the sweets. Our results show that the increased protein ratio cause a harder more chewy texture, however it might be a positive change in sensorial point of view.

THE EFFECT OF DIFFERENT TEMPERATURES ON THE LIQUID EXTRACTION FROM PLEUROTUS OSTREATUS (JACQ.:FR.) KUMM. MUSHROOM

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The extraction of the mushroom liquid with cooking and without added "solvent" is a significant technological innovation, as this step is more economical and is suitable to dissolve water-soluble bioactive compounds, for example, β-glucan. In this study, the effect of low temperature-long time cooking heat treatment on the liquid extraction from edible mushrooms was investigated.

Firstly, the heat treatment was processed with the usage of vacuum-packed sliced mushrooms in a drying cabinet (60, 70, and 90 °C; 24, 48 hours, and 1 week) and the manual filtering was tested. After manual filtration, the pressure cooker and centrifuge were also tested (90 °C, 24 hours). Furthermore, Arduino software was used to study the speed of the mushroom liquid flowing (80, 85, 90 °C, and 15 hours). The average amount of the extract and production loss was calculated.

Based on the results, it can be said that in the case of manual filtering, the percentage (%) of the extracts was between 0.0 (90 °C, 48 hours and 1 week) and 33.6% (60 °C, 48 hours), in contrast to the centrifugation, where this value was between 54.6 and 60.1 (90 °C, 24 hours). According to the Arduino test, 2 hours could be enough for extraction. The usage of a pressure cooker, centrifuge, and Arduino software has shown to be a proper tool for quality control and studying some changes during cooking methods.

APPLICATION OF DATA ANALYSIS METHODS IN DETERMING THE MIGRATION KINETIC OF POLIMER ADDITIVIES

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Plasticizers are often added as additives to plastics that come into contact with food, therefore the investigation of their migration is crucial. The migration kinetics of stabilizer-type additives from polylactic acid (PLA) and polypropylene (PP) were assessed. Depending on the plasticizer concentration, the swelling of plastics was also examined. The necessary contact time to reach the steady-state was obtained with the use of variography by determining the range (in this case the contact time) beyond which the observations are uncorrelated. ANOVA was applied to find significant differences in the additives' concentration of the plastics on the plateaus. The migration and swelling kinetic curves were classified by hierarchical cluster analysis, with Ward's method. The results showed that the concentration of the plasticizer has a strong connection with migration rate of additives. Similarity was showed by hierarchical cluster analysis in the migration kinetics of stabilizers from plastics with low plasticizer concentration at high temperature, to that at low temperature from plastics with high plasticizer concentration.

BIOCONTROL OF AFLATOXIN CONTAMINATION AND THE EFFECT OF ASPERGILLUS FLAVUS ON MAIZE QUALITY

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Maize is ranked the world's second most important cereal crop with nutritional benefits. However, maize contamination with aflatoxins produced by Aspergillus species is a global health threat to humans and animals. Biocontrol with atoxigenic A. flavus is a possibility against aflatoxin production on fields. However, fungal contamination could affect grain quality. Therefore, the study was conducted to assess the effect of toxigenic and atoxigenic fungal contamination on the nutrient value and mycotoxin content of maize kernels. A three-year experiment was conducted in Hungary between 2020-2022. Mycotoxin content was determined using HPLC technique. Data were analyzed using Genstat. Results showed that fungal contamination and aflatoxin production did not significantly affect ($p<0.05$) the protein and starch content. Starch content in Aspergillus contaminated maize was 61% compared to 63% in control. The protein content in Aspergillus contaminated maize and control was about 12%. The study, therefore, concluded that A. flavus contamination and aflatoxin production did not show a significant effect on maize grain nutrients.

Funding: This research was funded by the NATIONAL RESEARCH, DEVELOPMENT, AND INNOVATION FUND OF HUNGARY project no. 2018-1.2.1-NKP-2018-00002.

CRISIS LEADERSHIP: IS IT IMPORTANT?

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Nowadays crises are more and more frequent and complex. From this derives a concerted effort to develop a good leader in crisis. Leadership is most important in times of crisis, but we find that it is a relatively underdeveloped area. This article attempts to provide an overview of the definition of the main types of crisis and the key competencies for crisis management. Sense-making, decision making, communicating, coordinating teamwork and facilitating learning are the key competencies for crisis leadership. These competencies are necessary for a good crisis leader and the article presents suggestions to guide thinking in relation to each of these competencies.

EVALUATION OF WATER CALTROP (TRAPA NATANS L.) HARVESTED FROM LAKE TISZA, HUNGARY

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Water caltrop (*Trapa natans* L.) is a floating-leaved aquatic plant and protected species in Hungary. However, it reduces the free water surface, and its fruits with barbed spines are dangerous in the mud. We aimed to study the nutritional potential and food safety parameters of *Trapa natans* L. for further food utilization. Floating water caltrop plants with fruits were harvested from Lake Tisza, Hungary, under official permission. We analyzed the fruits' macro-composition and inorganic elements content, including heavy metals. The fruits were selected into groups by weight and hardness. The hardness of the fruits was determined after a 1% cellulase treatment. The dehulled, fresh kernel was separated into juice and pomace using a screw press juice maker. Juice was clarified by centrifugation. The separated biomass was immediately measured based on color, dry material, and water-soluble dry material. The water caltrop kernel is a good source of bioactive substances (protein, ash, carbohydrates), is high in Potassium, and does not contain heavy metals (As, Hg, Pb, Cd). The water caltrop juice has high dry material and soluble solids content (Brix). The juice and the pomace color do not change within a shorter time - during processing and measuring- at room temperature. The water caltrop fruit harvested from Lake Tisza (Hungary) is suitable for food utilization.

INVESTIGATION OF TANNASE ACTIVITIES IN MUCOROMYCOTA FUNGI

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Tannases cleave ester and depside bonds present in hydrolysable and complex tannins. In the food- and pharmaceutical industries, these enzymes can be used as clarifying agents and for the green production of gallic acid that is an intermediary compound in trimethoprim synthesis. Although many microorganisms have been characterized for tannase production, Mucoromycota fungi were less studied in this regard. In this work, an attempt was made to screen Mucoromycota fungi for their tannase production, including the analysis of the enzyme production under different fermentation conditions. A total of seven Mucoromycota strains were selected for the analysis, in which tannase activity was tested on agar plates supplemented with tannic acid as an inducer. Strains of *Rhizomucor miehei*, *Mucor corticolus*, *Mucor lusitanicus*, *Rhizopus microsporus* var. *oligosporus* and *Rhizopus oryzae* were able to tolerate the inducer and produce the enzyme in detectable amount. Tannase production of these fungi was further examined in wheat bran-based solid-state and yeast-peptone liquid conditions containing tannic acid as an inducer. Enzyme activity in the ferments was measured using the methanol-rhodanine spectrophotometric assay. The tannic acid proved to be an excellent inducer of tannase production in both systems. Among the tested fungi, the *R. microsporus* var. *oligosporus* resulted in the highest tannase activity in the solid-state fermentation tests, while the *R. miehei* was excellent tannase source in the submerged fermentations. Our results highlighted Mucoromycota fungi as potential tannase producers for future investigations. This research was supported by the grants NKFI FK134886, TKP-2021-EGA-28 and NTP-NFTÖ- 22-B-0095.

INVESTIGATION OF THE EFFECT OF AERATION AND TEMPERATURE ON MICROALGAE CULTIVATION IN DIFFERENT NUTRIENT SOLUTIONS

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Without recycling waste, the concept of the circular economy (CE) cannot be implemented. Recycling organic waste is of paramount importance in the agricultural sector since it can have high-added nutrient value. Moreover, cultivation and utilization of microalgae (e.g. Chlorella vulgaris) have attracted a lot of attention from many researchers. Microalgae have unicellular structure, with significant growth that can produce a large biomass and can be used as animal feed, substrate for biofuel production and a protein supplement.

The objective of the research was to investigate the cultivability of Chlorella vulgaris in different nutrient solutions considering the effect of aeration and temperature. During the research, two different nutrient solutions had been examined: ATOX II-BBE (A) and modified BG-11 with increased nitrate and phosphate concentration (T3) under aerated (airflow: 12 L/min) and non-aerated circumstances. The samples were investigated weekly from a chemical as well as biological point of view. The temperature data was acquired daily using thermometer sensors. For the chemical measurements, PF-12 plus photometer with VisoColor and NanoColor test kits were used and the following parameters were measured: NH4+, NO3-, K+, PO43-, chemical oxygen demand (COD), pH and electric conductivity (EC). AlgaeToximeter II was used for the determination of biological parameters like chlorophyll concentration and microalgae activity rate. Moreover, the change of chlorophyll A was tracked over the investigated period by a double beam spectrophotometer.

The results showed that the initial chlorophyll concentration (approx. 200 μg/L) had increased in each nutrient solution. The highest cultivation rate was observed in case of the aerated T3 and non-aerated T3 nutrient solutions with the value of 762 μg/L and 753 μg/L by the fifth week of the cultivation process. The microalgae activity rate remained nearly constant in non-aerated A, non-aerated T3 and aerated T3 solutions with 66%, while it dropped to 51% in aerated A solution. Among the measured chemical parameters, NO3-, PO43- and K+ showed an overall decreasing tendency in the observed period. COD increased from 62 mg/L O2 to just above 100 mg/L O2 in non-aerated A and aerated A samples, while non-aerated T3 and aerated T3 samples showed a slower pace of increase (from 225 to 250 mg/L O2). The UV-Vis spectrophotometer results are in accordance with the microalgae cultivation, higher absorption values were detected in the red region at 642 nm and in the blue region at 372 nm due to the increase of chlorophyll A.

THE IMPACT OF LACTIC ACID AND ASCORBIC ACID MIXTURE ON QUALITY PARAMETERS OF WILD BOAR MEAT

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The objective of the current research was to evaluate effect of organic acids in the European wild boar (*Sus scrofa* L.) meat and to investigate the ageing procedure in vacuum packaging. Wild boar meat is reported to contain a lower concentration of fat and cholesterol than the meat from the domestic pig. Therefore, recent increases in natural populations, as well as the possibility of farming wild boars have stimulated interest in this species as a meat producer. In this study the effect of lactic acid and ascorbic acid mixture was evaluated in wild boar meat on meat quality parameters like pH, water holding capacity, water activity, and micro-biological evaluation. Certain parameters are considered as indicators of fresh meat shelf life. Lactic acid 2% and ascorbic acid 2% was mixed and sprayed on wild boar meat samples. The meat samples were immediately vacuum packaged after treating and stored at 4 ± 1°C for 21 days of display. Quality parameters were measured on 1, 7, 14, and 21 days. The results indicate that the use of lactic acid and ascorbic acid mixture could be an alternative to extend meat shelf life.

A RURAL DEVELOPMENT PERSPECTIVE ON THE CHALLENGES AND PROSPECTS OF THE HUNGARIAN LIVESTOCK FARMING SECTOR

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This research explores the challenges facing livestock farming in developed countries, such as environmental impacts and the disappearance of the backyard and small-scale farms. Focusing on the Hungarian livestock sector from the 1990s to recent years, the study used statistical analysis, policy document and literature review, and interviews (n=66) in Hungary's Southern Great Plain NUTS2 region. The aim was to investigate farm concentration, environmental effects, and young farmers' difficulties. The results show a significant decrease in the number of farms and animals kept in rural areas. The reasons are complex, ranging from the weakening of cooperatives to market problems and animal welfare measures. The established large-scale industrial animal husbandry is an environmental burden without positive externalities. The loss of backyard and small-scale livestock farms from the Hungarian countryside has resulted in multifunctionality loss and social exclusion and negatively impacted local communities. In our opinion, a diversified farming system and balanced policy preference for small-scale animal husbandry meeting family and local needs can bring many environmental, economic, and social benefits to rural Hungary. It may promote biodiversity, self-sufficiency, food security and sovereignty and help young farmers start their businesses. This research was supported by the János Bolyai Research Scholarship of the Hungarian Academy of Sciences (BO/00413/17/10).

COMBINED EFFECT OF NATURAL LEMON ESSENTIAL OIL AND LEMON JUICE PRESERVATIVES ON PEAR AND RASPBERRY MILKSHAKES

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As the importance of reducing food waste and sustainability in the food systems grows, natural food preservatives have gained more popularity to use in food preservation method. Essential oils (EOs) have a great potential to be a safe and environmentally friendly preservative due to their beneficial properties such as antimicrobial, antifungal and antioxidant. This study aims to examine the antimicrobial efficacy of combined pasteurized lemon juice and lemon essential oil as a natural preservative on pear and raspberry milkshake. The sensory evaluation was conducted in order to determine the most acceptable milkshake ratio and further used to investigate the shelf life. The milkshakes were prepared in different milk and fruit juice ratio as 60:40, 70:30 and 80:20 for the sensory evaluation. To evaluate the preservation effect of natural preservative, different treatments which were 1% pasteurized lemon juice, 0.25 µl/ml lemon essential oil and combined 1% pasteurized lemon juice and 0.25 µl/ml lemon essential oil were applied. The milkshakes were then stored under refrigerator condition for four weeks with the assessment of microbiological evaluation every week. The sensory evaluation demonstrated that the milkshake ratio 80:20 and 70:30 are the most preferable to consume for pear and raspberry milkshake, respectively. Moreover, the results indicated that the combination of 1% pasteurized lemon juice and 0.25 µl/ml lemon essential oil as a natural preservative, showed synergistic effects in the inhibition of microbial growth in pear and raspberry milkshakes during the storage.

COMPARATIVE ANALYSIS OF MEAT PRODUCTS MADE FROM DIFFERENT MEAT RAW MATERIALS

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During the production of meat products (e.g. Bologna sausage, frankfurters) we can use, in addition to meat, mechanically deboned meat (MDM) and mechanically separated meat (MSM), however, the latter cannot be considered meat due to certain regulations.
The aim of our research work was to compare the characteristics of Bologna sausages made from chicken fillet, chicken MDM and poultry MSM.
Our meat raw materials tested during our measurements included chicken breast fillet, chicken breast MDM and poultry MSM. In addition, we also used water, pork fat, nitrite salting mixture, and tetrasodium-pyrophosphate (Soluprat) to produce the sample. 1 mix was 400 g. The finished products were placed in cans and heat-treated in this way (in a water bath at 75 °C for 65 minutes). We used this procedure instead of the natural casings filling, because due to the small amount of the experimental products, a significant amount of technological loss should have been expected.
The examined product characteristics included the measurement of cooking loss, instrumental chemical composition measuring, colour measurement, stock measurement, determination of water activity, pH measurement, and sensory evaluation of the samples. Overall, based on the results obtained during all these tests, we tried to formulate the differences between the raw materials.
After evaluating our tests, we came to the conclusion that in the case of production with MSM, we can produce a lower quality product using the same amount of meat raw material, which can actually be improved by using more additives (e.g. carminic acid, tetrasodium-pyrophosphate).
Acknowledgement: Supported by the ÚNKP-22-1-SZTE-197 New National Excellence Program of The Ministry for Culture and Innovation from the source of The National Research, Development and Innovation Fund.

DOES SOIL MATTER? HELPING BIODIVERSITY MANAGEMENT IN A SOLAR PARK

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There has been a serious increase in solar energy installations in Hungary recently. The majority (98.6%) of the installations were done as green field investment. Due to the nature of technical intervention in the agricultural landscapes, some of the results of these investments was the disturbance of the environment (soil and water), change of landscape (and its values), and reduction in biodiversity of these areas. Due to the increase of land use and land cover change, especially towards soil sealing or reduced availability, it should be important to maintain or improve the role of such places as habitats, besides producing the equally important renewable energy forms. Solar parks on former greenfield areas cover a significant amount of soil surface, and there are tremendous works related to soil resources, their soils are changed during the investment and thus soil properties influence their biodiversity management plan. An important step in habitat development is revegetation. During planting valuable plants for improvement of the biodiversity, it is also important to adapt the plans to the environmental of the solar parks, and also, to its technical parameters. In the recent study soil samplings were done close to the disturbed area and on a nearby natural area. Soil properties were measured by a Near Infrared device. Soil organic matter and N-content resulted differences besides others. The deviation of soil properties proved the importance of soil investigation in this case as revegetation requires knowledge on soil to find the proper plant species for the soils on-site.

FERMENTATION OF EGG WHITE DRINK BY *BIFIDOBACTERIUM* WITH DIFFERENT CARBOHYDRATE SOURCES

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Egg white drink is a good alternative for consumers who suffer from lactose intolerance or have severe milk protein allergy. The aim of our research is to investigate the usability of egg white for fermentation by probiotic bifidobacteria.

The growth of *Bifidobacterium longum* Bb46 and *Bifidobacterium longum* DSM 16603 in enzyme-treated egg white drink was investigated. 3 different carbohydrate sources, monosaccharides (glucose and fructose) and disaccharides (saccharose) were added separately to egg white at a concentration of 2% and fermented samples without adding carbohydrates were served as a control. Afterward, the pH value, the cell count, as well as the cell yield was measured in the final products, additionally, the changes in protein profile were also evaluated by SDS gel electrophoresis.

After 24 hours of fermentation, a reduction in pH value was observed particularly when carbohydrate sources were added to egg white drink compared to control samples.

Generally, the total cell count was greater than 8.3 log10 CFU/mL, and the cell count of *B. longum* DSM 16603 was considerably higher than *B. longum* Bb46 in egg with supplemented with glucose and saccharose.

Following SDS protein profile analysis of all studied samples, ovalbumin, ovoflavoprotein, and ovomucoid were detected in all studied samples, although their associated bands were fainter when carbohydrates were added but still visible in the gel. To sum up *B. longum* DSM 16603 can be applied for production of fermented probiotic egg white drink.

IDENTIFICATION OF BIOACTIVE COMPOUNDS USING RP-HPLC ANALYSIS OF SOME HAWTHORN SPECIES EXTRACTS *(CRATAEGUS PINNATIFIDA BGE., C. MONOGYNA JACQ., C. CRUS-GALLI)* AND ANTIOXIDANT ACTIVITY EVALUATION.

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Hawthorn belongs to the Rosaceae family and is one of the plants that has been used as a source of bioactive substances. The aim of this work was to determine the phenolic and flavonoid content and antioxidant activity of ethanol extracts of several hawthorn species (Crataegus pinnatifida Bge., C. monogyna Jacq., C. crus-Galli). Extraction was performed using 50 v/v% ethanol as solvent (10 g fruit in 100 ml solvent) at 45 °C for 50 min. The Folin-Ciocalteu method was used to measure total phenols, the aluminium chloride method was used to measure flavonoids, and the ferric reducing antioxidant power (FRAP) method was used to assess the antioxidant activity of the extracts. Identification of phenolic compounds present in the extract was performed by RP-HPLC. A positive linear correlation was observed between the index of antioxidant activity and the total phenolic content of ethanol extracts. The order of antioxidant activity between species was as follows (C. crus-galli > C. Pinnatifida Bge. > C. monogyna Jacq.). RP-HPLC method showed that the most abundant compounds were chlorogenic acid, ferulic acid, ellagic acid, and (+)-catechin, whereas gallic acid and caffeic acid were not detected. The extract has important antioxidant properties due to the presence of phenolic compounds. Of note is C. crus-galli species, their extracts have not been studied or mentioned to our knowledge.

MONITORING THE SPOILAGE PROCESS OF DAIRY PRODUCTS BY DIELECTRIC MEASUREMENT

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The dielectric behaviour of biological materials has been studied for decades, as measurement methods based on dielectric properties offer promising new development opportunities in several fields of scientific research and industrial technologies due to its simple, quick and accurate useability. In our study, the changes of dielectric constant and dielectric loss factor were measured during the storage and spoilage process of fermented dairy products. The dielectric parameters were determined in the frequency range of 200-2400 MHz with an open-ended coaxial dielectric probe. During the deterioration, the number of viable lactic acid bacteria (Lactobacillus spp.) was also determined by using the standard plate count technique. Our aim was to determine whether the changes in dielectric parameters are correlated with the microbiological properties of yoghurts during storage at 20 °C. Our results show that physicochemical changes caused by the microbial metabolic activity are reflected in dielectric behaviour of the products. While the microbial growth is closely linearly related to the change in dielectric constant at 400 MHz frequency, second-order polynomial relationship was observed between the change of the dielectric loss factor and the number of viable cells. Our results verified, that the dielectric measurement method is suitable for monitoring the spoilage process and for determine the expressed deterioration rate of fermented dairy products.

The research is supported by the UNKP-22-2-SZTE-199, UNKP-22-5-SZTE-208 and UNKP-22-3-SZTE-204 New National Excellence Program of the Ministry for Culture and Innovation from the source of the National Research, Development and Innovation Fund, and by János Bolyai Research Scholarship of the Hungarian Academy of Sciences (BO/00161/21/4).

PROBIOTIC FERMENTATION OF MIXED FRUIT AND VEGETABLE JUICES

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In the rise of a growing trend towards vegan origin product consumption and certain diet limitations in consumers, fruit- or vegetable-based non-dairy probiotic beverages become quite an appealing substitute. By nature, vegetables and fruits are rich in dietary fibers, carbohydrates, vitamins, minerals, phytochemicals and polyphenols, thus can be a potential substrate or prebiotic in the production of probiotic beverages and fulfill probiotic carrier function to benefit human gut health. In addition, previous studies show that antioxidant activity of plant – based food products enhances post fermentation due to their liberation or new formation of antioxidant compounds. Such qualities allow the fermented fruit and vegetable juice to have a promising future and attract beverage industries' attention. The aim of this study is to evaluate the probiotic cell count viability in 72h fermented with *Levilactobacillus brevis* juice mix made of beetroot, apple and carrot, and conclude on the most suitable environment for probiotic shelf life. Besides, the sensory evaluation conducted in parallel to understand the consumer behavior towards a new product. As a last parameter, antioxidant activity is measured to draw a conclusion on whether fermentation enhances the antioxidant compound number in juice. According to results obtained, mix of fruit and vegetable juice seems to be a good environment for the probiotic strain due to viable cells found after 4 months of storage. However, due to its novelty, the main issues remain as the customer acceptance of sensory properties, which hinders the entrance of non-dairy probiotics entering the market on full basis.

THE COMBINED EFFECT OF LEMON ESSENTIAL OIL AND LEMON JUICE AS NATURAL PRESERVATIVES IN APPLE AND GRAPE JUICES

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The desire for natural preservatives is motivated by the demand for safer, healthier, and more sustainable food products that meet modern consumer expectations. Lemon as a natural preservative in fruit juices have the potential to extend shelf life, and satisfy consumer demand for natural products and could potentially increase the antioxidant activity. Grape and pear can be found globally and are usually turned into juices for the everyday diet. The aim of this study is to examine the combined effect of two natural substances (lemon essential oil and lemon juice) in inhibiting microbial growth and extending the shelf life of the fruit juices. Different treatments were applied to the juices, including untreated juice, pasteurized juice, addition of lemon essential oil (0.25 µl/ml) and 1% lemon juice to untreated and heat-treated juice. To evaluate the effectiveness of the natural preservatives, cell number measurements were taken for 4 weeks under chilled conditions. The pH, antioxidant activity, and sensory evaluation of juices were also assessed. The results showed that combining lemon essential oil and lemon juice could inhibit the growth of bacteria and yeast while also influencing the antioxidant activity of pear and grape juices. Furthermore, sensory evaluations indicated that the treated juices with a combination of lemon essential oil and juice were acceptable to consumers. These findings imply that lemon essential oil and lemon juice can be used as natural preservatives in fruit juices while maintaining their sensory properties.

THE EFFECT OF ENZYMATIC PRETREATMENT OF CHICKPEA ON PROPERTIES OF PREPARED PROTEIN NANOPARTICLES

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Usage of proteins in nanotechnology and preparation of nanoparticles can be designed to meet the demands for different applications in food industry and lend opportunities for the improvements such as enhancement of flavour, extension of shelf life and advancement of the techno-functional properties of food products. The aim of the present work was to produce protein nanoparticles by heat treatment and to evaluate their properties. Protein isolates from defatted chickpea flour were prepared by alkaline and enzyme-assisted alkaline extractions (using single arabinofuranosidase or combination of cellulase and xylanase). Nanoparticles were fabricated from protein isolates by heat treatment at 90°C and at varying pH (7 or 9.3) and treatment duration (10 or 20 min). Evaluation of turbidity, surface hydrophobicity and storage stability of prepared nanoparticles were determined. Obtained results showed that the highest turbidity of protein dispersion was recorded for arabino-assisted alkaline nanoparticles, followed with alkaline and (xylanase+cellulase)-assisted alkaline nanoparticles at pH 7, as well as at pH 9.3 where the same trend was observed. Surface hydrophobicity of all nanoparticles was significantly increased compared to native protein solutions. It has been found that the highest values of surface hydrophobicity were determined for nanoparticles prepared from alkaline isolate at both investigated pH. Moreover, more stable nanoparticles were produced from protein isolates obtained from enzyme-assisted extractions, and at higher pH. Results of this study suggest that enzymatically extracted chickpea protein isolates can be used for preparing stable nanoparticles with characteristics desirable for food industry.

THE INFLUENCE OF CONTENT OF OREGANO ESSENTIAL OIL ON MICROSTRUCTURAL, ANTIOXIDANT, BARRIER AND ANTIMICROBIAL PROPERTIES OF CITRUS PECTIN-BASED EDIBLE FILMS

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In recent years, there is a growing interest to use biopolymer films or coatings as food packaging materials. Bio-based polymers such as polysaccharides, proteins, lipids and their composites could successfully replace petroleum-based materials due their biodegradability, abundantly distribution and renewability. The biopolymer films and coatings act as a passive barrier that protects food products from environmental factors such as ultraviolet light, oxygen, water vapor, pressure and heat. Pectin is an easily accessible polysaccharide in nature that is non-toxic, biodegradable and edible. Due to its gelation capacity, it is considered as good matrix for edible film production with application in food packaging. The incorporation of different additives like plasticizers, emulsifiers and cross-linking agents, as well as active compounds in pectin films could give them good water barrier, antimicrobial, mechanical and antioxidant properties.

The present study aims to develop pectin edible films based on citrus peel pectin and oregano (*Origanum vulgare* L.) essential oil. The oregano essential oil (OEO) was added to four final concentrations (0.05, 0.1, 0.5 and 1%). Polyethylene glycol 400 was used as a plasticizer and Tween® 80 was added as a surfactant. The results of microstructural, barrier, antioxidant, antibacterial and antifungal analyses of the OEO-pectin films were compared with control films (without OEO) to determine the effect of content of oregano essential oil on films properties. The obtained emulsions were also used to coat cut apples, in order to extend their freshness.

THE RELATIONSHIPS OF THE EUROPEAN UNION PROJECTS IMPLEMENTED IN DEBRECEN IN THE PERIOD 2014-2020 AND THE BIOLOGICAL ACTIVITY VALUE

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In the study, the implemented European Union development projects of the city of Debrecen for the period 2014-2020 are evaluated based on their effects on the green infrastructure. Our aim is to reveal to what extent the development projects occupied green areas and, accordingly, what amount of green area compensation would be required. The tests were carried out by classifying and analyzing the projects and calculating the biological activity value. The basic principle of the calculation of the biological activity value laid down in the law is that the areas included in the settlement plan are provided with values, so-called biological activity value multipliers, proportional to the hectare level according to their role in the urban fabric, their properties and surface coverage. The values obtained by multiplying the extent of the demarcated areas in hectares and their activity values give the total biological activity value of the chosen area. In our research, we divided the topic of biological activity values into two groups, the project-level calculation (information in the possession of implementing bodies), and the examination of the effects related to settlement planning, which are publicly available in development and planning documents. Based on these, the cumulative biological activity value of the 38 development projects evaluated in the landscape use section is 201.9475. This indicator means that the implemented developments caused a decrease in biological activity value for the city in total.

XYLANASE AND CELLULASE ASSISTED ACID EXTRACTION OF PECTIC FIBER FROM BUTTERNUT SQUASH

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Conventionally, pectic fibers are isolated from plant tissues by means of acidic extraction. As the demand for pectin continually grows it is necessary to enhance the isolation protocols in order to obtain higher yields and better characteristics of this fiber. The use of different cell wall degrading enzymes for the treatment of plant material prior to acidic extraction is suggested in the literature as a way to achieve these goals. On the other hand, butternut squash (*Cucurbita moschata*) is an unconventional source of pectic fiber. The use of this common cultivar for this purpose could additionally increase the quantities of pectin available on the market. This study aimed to investigate the effect of enzymes in a treatment prior to acidic extraction on the yield and characteristics of pectic fiber from butternut squash and compare it with the one extracted by acid. Commercial cellulase and xylanase were cell wall degrading enzymes applied together. The yield of enzyme-assisted and conventional acid extraction was 81.0 mg/g_{DW} and 60.6 mg/g_{DW}, respectively. The content of galacturonic acid was 2.3-fold higher in pectin polysaccharide obtained with the assistance of enzymes, while its degree of methoxylation was approximately 10% lower. Furthermore, pectic fiber isolated with the assistance of enzymes had a higher content of homogalacturonan in its structure, while the acid extracted one comprised more of rhamnogalacturonan-I. The results of this study revealed a considerable influence of enzymes' involvement in the extraction procedure on the yield and characteristics of pectin from butternut squash.

Acknowledgement: This study was supported by the Ministry of Education, Science and Technological Development, Republic of Serbia (Project no: 451-03-47/2023-01/ 200134).

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